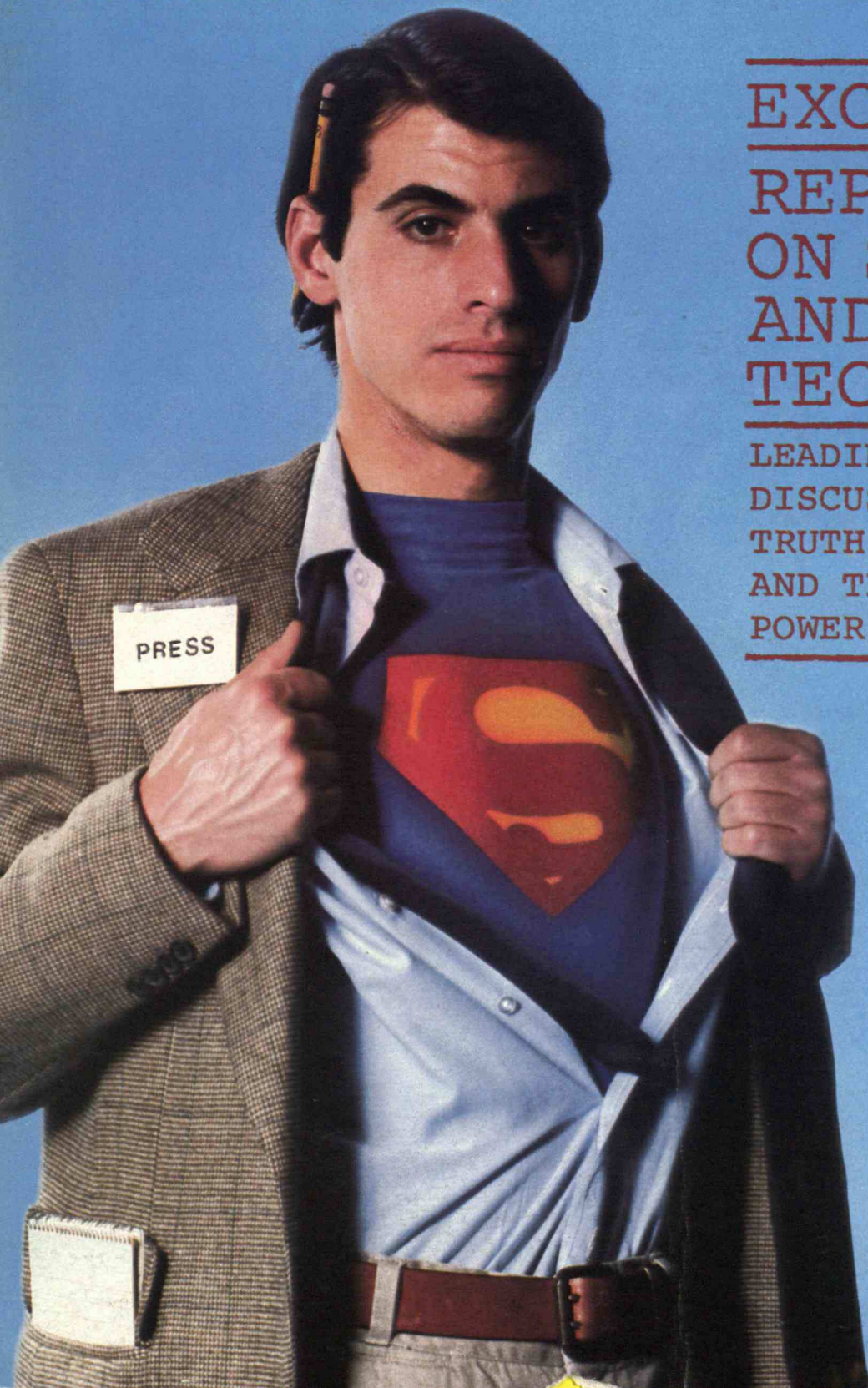


March/April, 1980
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Diversity for a Sustainable Society
Chronic Lead Poisoning
in Children
Energy Conservation Comes Home

Technology Review

Edited at the Massachusetts Institute of Technology



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SCIENCE/SCOPE

Major developments toward an optical filter that can be tuned electronically to specific wavelengths of light have been reported by Hughes scientists. The device is tuned by a microprocessor that varies the electric field distribution onto an electro-optic crystal. One filter with a lithium-tantalate crystal has been operated across the visible light spectrum from deep blue to deep red. Another has been tuned into the infrared portion of the spectrum. The device promises to find important uses in pollution monitoring, multispectral imaging, and monitoring color consistency in a wide range of commercial products.

Using digital techniques to perform image processing tasks like scan conversion and information storage, a new microprocessor-controlled display system is finding a wealth of applications from medical diagnoses to non-destructive testing. The system, called the Hughes Anaram 80" digital signal processor, is designed to create images with the natural look of analog displays while providing the data-handling benefits of digital techniques. The system can display 60 images per second, freeze one picture for an hour, enhance obscured detail, and display four pictures simultaneously for comparative analysis. Uses include medical ultrasonography, X-rays, radar, graphics terminals, and image transmission.

An advanced goggle that allows soldiers to see at night has been developed by Hughes for the U.S. Army's Night Vision Laboratories. The device, called a holographic one-tube goggle, employs thin-film diffraction optics and advanced electronics. It amplifies dim visual light and near-infrared radiation, then superimposes the enhanced image over the wearer's view. Aided by studies on how the brain overlaps the field of view of each eye, human engineering specialists designed the goggle so that the image intensifier tube, which extends from above the bridge of the nose, would not block any portion of a person's view.

An Exotic chip that would alert a pilot when he has been detected by enemy radar promises to open a new arena in modern electronic warfare. The unique wafer, called an integrated optic spectrum analyzer (IOSA), would allow a pilot to prepare for a dogfight, turn on jamming equipment, or take any other appropriate action. The device works by having a surface acoustic wave device convert processed radar signals into sound waves. These sound waves interact with light from a tiny solid-state laser and cause the beam to bend toward a detector array of charge-coupled devices. The amount of deflection indicates the frequency of the radar signal. The IOSA is being developed by Hughes for the U.S. Air Force.

Highly complex microcircuitry soon may be mass produced with a technique being pioneered at Hughes. The approach, called ion beam lithography, has been used to make very large-scale integrated circuits (VLSI's) having circuit lines as narrow as 0.1 micrometer, about 4 millionths of an inch. These minute dimensions have been possible only by tedious, painstaking methods that use an electron beam to draw circuitry on a wafer. Ion beam lithography, however, is faster and less costly because it uses a collimated beam of protons to "photograph" circuit patterns from a mask onto a whole chip.

Hughes is currently seeking new graduates in electrical, mechanical engineering and computer science or other closely aligned disciplines to meet the demanding challenge of our high technology company. To obtain further information, please write: Manager, College Relations, Hughes Aircraft Company, P.O. Box 90515, SS/100/445, Los Angeles, CA 90009.



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They regulate the speed, torque and acceleration of the car's DC motor.

Their high-frequency characteristics also make them ideal as components for the car's overnight charging system.

Finally, the transistors play a big role in the car's regenerative braking system. They help change the motor automatically into a generator, supplying

braking power to the wheels and producing current to partially recharge the batteries.

What's coming down the road after this advanced vehicle? GE engineers are developing one that's even more advanced. It's a hybrid that will burn far less fuel than an all-petroleum-powered car and have even greater range and power than the all-electric. It too will feature microelectronic controls...but of even greater sophistication.

Looking for new and practical solutions to transportation problems is just one example of research in progress at GE. We're constantly investigating new technologies, new materials and innovative applications for existing technologies — in such areas as energy sources, motors and drives, aerospace systems.

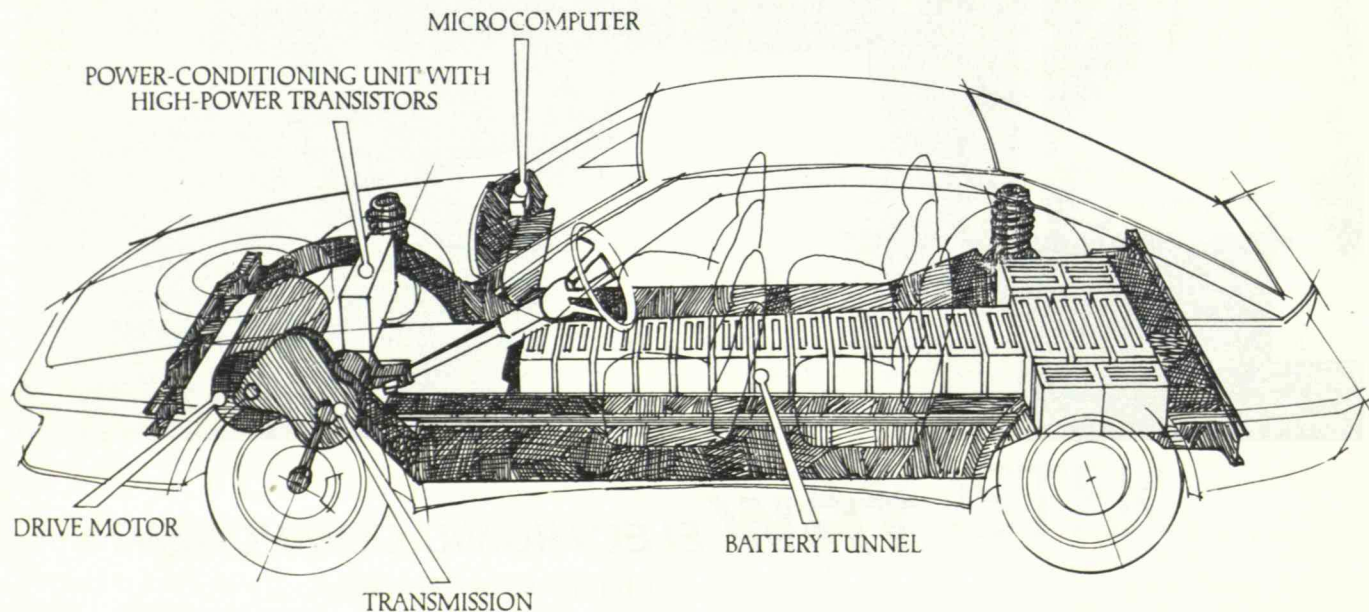
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Technology Review

FEATURES



Science, Technology, and the Press
Page 46

Cover photo by Ralph Mercer
Design by Nancy Pokross

24
**Drilling for Oil and Gas
in Our Houses**
By Robert H. Williams and
Marc H. Ross

A systematic plan for recovering the energy, now wasted, from the "oil and gas fields" that are our homes.

38
**Lead Exposure and Human Health:
Recent Data on an Ancient Problem**
By Herbert L. Needleman, M.D.

Lead's adverse effects occur at lower doses than previously believed, and the primary victims are children.

46
**Science, Technology, and the Press:
Must the "Age of Innocence" End?**
Panel Discussion

Eight prominent science journalists discuss the responsibilities of the press — to truth, justice, and the public good — in its coverage of science and technology.

58
Variety Is the Key to Life
By Paul R. Ehrlich

A renowned scientist argues for diversity — biological, genetic, cultural, and technological — as an essential aspect of civilization.

TREND OF AFFAIRS

70
Living

73
Petroleum

76
Human Reproduction

COLUMNS

6
Society:
Kenneth E. Boulding

Cost, benefit, and the concept of sin.

8
Technology and Science:
Robert C. Cowen

The "endless frontier" of scientific inquiry need not be abridged, but it must embrace the needs of all humankind.

10
Forum:
Ruth Hubbard

The technology of in vitro fertilization — "test-tube babies" — is beginning to develop. But is it safe? And is it necessary?

62
Environment:
Norman Myers

Some conservationists may argue that every species has a "right" to exist, but we can only save a small fraction of those that appear doomed to extinction.

16
Books and Comment

The Right Stuff, reviewed by Charles Ball; *New Inventions in Low-Cost Solar Heating: 100 Daring Schemes Tried and Untried*, reviewed by Robert Jeffries

DEPARTMENTS

2
First Line

2
Letters

78
Croctic

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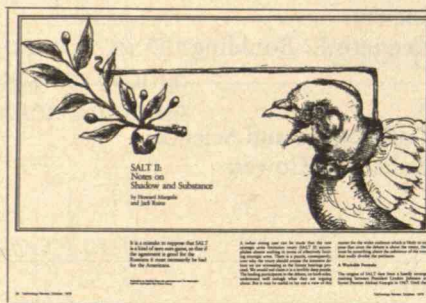
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Basking in Graphics

With pride that we hope will not seem unseemly, we call attention to *Technology Review's* recent success in a number of juried competitions in graphic design. The latest — and perhaps most prestigious — are citations by the Art Directors' Club of New York City for our March/April, 1979 cover (reproducing an example of modular arithmetic by Susan Jane Morris, then an undergraduate in mathematics at M.I.T.) and illustrations by Geoffrey Moss for our article on SALT (October, 1979, pp. 30-41). Two entries by *Technology Review* were accepted last year by *Graphis* magazine for its international exhibition, and one was chosen for a British exhibition by *Modern Publicity* magazine. In addition, we've been represented in shows of the University and College Designers' Association (a gold award in 1978), Art Directors' Club of Boston, and Society of Publication Designers.

These plaudits are almost all for *Technology Review's* art director, Nancy Pokross, who alternately supports and prods the editors and is in turn ably supported by our production manager, Kathleen Sayre. The rest of us bask happily in the spotlight shining on them. — J.M.



Left: Cover of March/April, 1979 issue; Above: Frontispiece illustration by Geoffrey Moss.

Particulates and Cigarettes

John Walker's finding that "the air in nonsmoking sections is no freer of particulates from tobacco smoke than is the air anywhere else on an airliner" (*Flying and Fear of Smoking*, *Trend of Affairs*, October, 1979, p.70) is not borne out by the evidence described.

There is no indication, for example, that the reported increase in the number of particles is due to tobacco smoke. The particles found may be due to the wear and tear of clothes, food, hair, face and body powder, general dust accumulation, etc. When people move around in a given area, these and other particles become suspended in the air. In the absence of information on the composition of the particles, it is inappropriate to attribute an increase in the observed particulate levels only to the presence of tobacco smoke.

It may be just as logical to conclude from Mr. Walker's evidence that the ventilation system in an airliner is so efficient that there is no buildup of particulates but only a suspension of preexisting ones into both sections of the airplane.

Raymond Fagan
Richmond, Va.

The writer is principal scientist at the Philip Morris Research Center. John Walker, whose work is described in the original article, responds:

Several investigators have studied the number and size of particles produced by cigarettes. Perhaps the most startling finding is a report that the mainstream smoke of one cigarette contains more than 1 trillion particles. Sidestream smoke, which comes off the tip of the cigarette and is not inhaled by the smoker, contains 3.5 trillion particles per cubic centimeter, and concentrations in the smoke range from 1 to 5 billion particles.

The average size of the sidestream particles is 0.15 centimeters. The range extends well into the region observed by the condensation nuclei counter. Cigarettes are a well-known combustion phenomenon; and combustion, whether it is a forest fire, a power plant, or a cigarette, is a major source of small atmospheric particles. In the indoor environment, such as an aircraft cabin, smoking can be the principal source of particulates. The sidestream smoke of only 24 cigarettes produced an ambient concentration of 16,650 micrograms per cubic meter in a closed ventilation chamber of 880 cubic feet. This level is 64 times the 24-hour

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Letters

National Ambient Air Quality Standard for particulates. The sources that Dr. Fagan suggests are due to abrasive and resuspensive forces which produce much larger but many fewer particles than combustion. The levels of particulates found in the airline cabin were very high and variable. They correlated with observed cigarette smoking activity. To suggest that dandruff or rapid deterioration of polyester suits caused these levels does not accommodate the facts or scientific reasoning.

Drawing Down Our Water Capital

Ronald F. Probst ("*Water for a Synthetic Fuels Industry*," Aug./Sept., pp. 36-43) does not seem to take into account the probability that direct human demand for water in the areas of coal seams in the West will increase, and that increase may be accentuated by the establishment of synfuel plants. We are in many parts of the West drawing water from capital accumulation over and above the annual input. It has been recently pointed out that Mono Lake is being dried up by Los Angeles. The ground water in Tucson in 1910 stood at 96 feet; in 1949 I was told that it had dropped to about 140 feet below ground level.

Charles H. Blake
Hillsborough, N.C.

The Other Side of the Defense Story

With your publication of "Defense of a Small Planet: An Interview with Philip Morrison" (November, 1979, pp. 60-68), *Technology Review* leaves its traditional fields of science and technology to enter the arena of political opinion. If the *Review's* nonpartisan reputation is to be preserved, an article telling the other side of the story on national defense must be circulated before the conclusion of the SALT II debate. You should have no trouble recruiting an author willing and able to point out the dangers of military weakness. Careful choice of an authoritative writer will reflect more credit on *Technology Review* than publication of an interview with an expert operating outside the field of his expertise.

Philip R. Jonsson
Dallas, Texas

Philip Morrison's statements are so false that they make me wonder if he is another American-born Soviet spy; M.I.T. has a reputation as a center for such people.

Apparently Mr. Morrison is unaware of the tremendous Soviet military effort which began after the Cuban crisis and is still continuing. The rest of the world is aware, if Mr. Morrison is not, that the vast Russian superiority in Europe in tanks, aircraft, guns, missiles, and military

manpower is a clear threat to world peace. The Russian navy is significantly outbuilding the U.S. Navy and probably now has the capability to deny us the oil, chromium, and other raw materials needed to fight a war. We unilaterally stopped our missile development several years ago, while the Russians have expanded theirs with the SS-20 already in production.

We are today in the same position relative to the Soviet Union that France and England were prior to World War II. If the Soviets choose, they can inflict on us that same type of defeat; perhaps that is what Mr. Morrison really wants.

E. J. Bataille
La Canada, Calif.

Professor Morrison responds:

Beyond the superfluous innuendo, Mr. Bataille is seriously misinformed about the Soviet SS-20. Whatever its mobility, the SS-20 is not at all a counterpart to our strategic missile system, MX, now under construction. SS-20 lacks transoceanic range; it is an intermediate-range missile rather like the upper stages of an ICBM. The U.S. missiles closest to it are our Pershings, which are mobile and semimobile.

Communication by Radar

Picture yourself on the bridge of the *Stockholm* as she is heading toward the *Andrea Doria*. The course, speed, and time to collision are being plotted at normal intervals. One question remains: "Is the captain going to turn right or left to avoid me?"

The present communications system (see "*Maneuvering into a Crash*," *Trend of Affairs*, November, 1979, pp. 78-79) is set up to give unlimited information. But you don't know what ship is approaching, so you can't call the captain. And if he speaks a different language, you might not understand him. In the meantime, the ships are closing . . . rapidly.

Suggestion: Use the radar. Send a long blast — or two blasts, depending on whether you are turning to starboard or port. And on the other bridge an automobile radar detector to convert the signals to sound. So the captain will mutter to the seaman on watch, "He's turning to port; steer a couple of degrees starboard," and lift his coffee cup to his lips once more to keep from falling asleep on these long, boring watches.

Paul J. Franzel
New York, N.Y.

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The travel program is a special one for alumni and alumnae of Harvard, Yale, Princeton, M.I.T., Cornell, Univ. of Virginia, and certain other distinguished universities and for members of their families. Now in its 16th year, it is designed for educated and intelligent travelers and planned for persons who might normally prefer to travel independently, visiting distant lands and regions where it is advantageous to travel as a group.

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SOUTH AMERICA and THE GALAPAGOS: A choice of itineraries of from 12 to 29 days, including a cruise among the islands of the Galapagos, the jungle of the Amazon, the Nazca Lines and the desert of southern Peru, the ancient civilizations of the Andes from Machu Picchu to Tiahuanaco near Lake Titicaca, the great colonial cities of the conquistadores, the futuristic city of Brasilia, Iguassu Falls, the snow-capped peaks of the Andes and other sights of unusual interest.

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THE SOUTH PACIFIC and NEW GUINEA: A primitive and beautiful land unfolds in the 22-day **EXPEDITION TO NEW GUINEA**, a rare glimpse into a vanishing world of Stone Age tribes and customs. Includes the famous Highlands of New Guinea, with Sing Sing and tribal cultures and customs, and an exploration of the remote tribal villages of the Sepik and Karawari Rivers and the vast Sepik Plain, as well as the North Coast at Madang and Wewak and the beautiful volcanic island of New Britain with the Baining Fire Dancers. To the south, the island continent of Australia and the islands of New Zealand are covered by the **SOUTH PACIFIC**, 28 days, unfolding a world of Maori villages, boiling geysers, fiords and snow-capped mountains, ski plane flights over glacier snows, jet boat rides, sheep ranches, penguins, the Australian "outback," historic convict settlements from the days of Charles Dickens, and the Great Barrier Reef. Optional visits can also be made to other islands of the southern Pacific, such as Fiji and Tahiti.

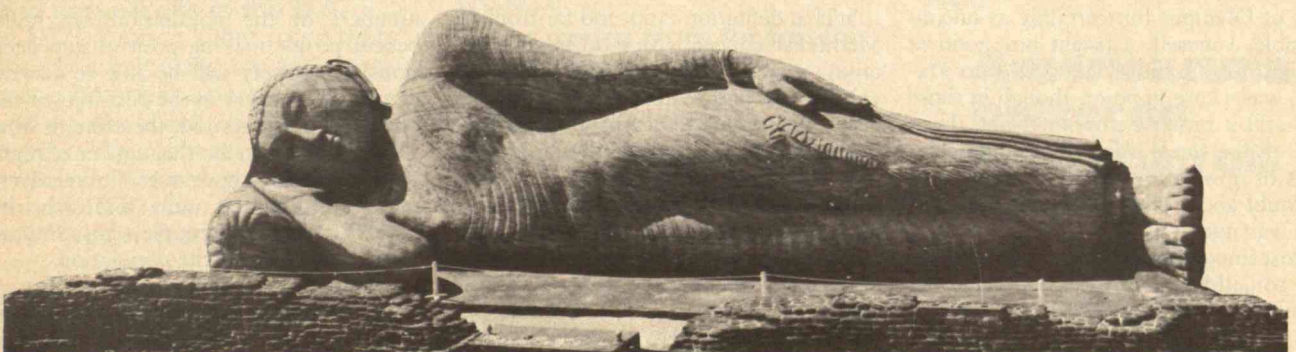
CENTRAL ASIA and THE HIMALAYAS: An expanded program of three itineraries, from 24 to 29 days, explores north and central India and the romantic world of the Moghul Empire, the interesting and surprising world of south India, the remote mountain kingdom of Nepal, and the untamed Northwest Frontier at Peshawar and the Punjab in Pakistan. Includes the Khyber Pass, towering Moghul forts, intricately sculptured temples, lavish palaces, historic gardens, the teeming banks of the Ganges, holy cities and picturesque villages, and the splendor of the Taj Mahal, as well as tropical lagoons and canals, ancient Portuguese churches, the snow-capped peaks of the Himalayas along the roof of the world, and hotels which once were palaces of maharajas.

THE FAR EAST: Itineraries which offer a penetrating insight into the lands and islands of the East. **THE ORIENT**, 30 days, surveys the treasures of ancient and modern Japan, with Kyoto, Nara, Ise-Shima, Kamakura, Nikko, the Fuji-Hakone National Park, and Tokyo. Also included are the important cities of Southeast Asia, from Singapore and Hong Kong to the temples of Bangkok and the island of Bali. A different and unusual perspective is offered in **BEYOND THE JAVA SEA**, 34 days, a journey through the tropics of the Far East from Manila and the island fortress of Corregidor to headhunter villages in the jungle of Borneo, the ancient civilizations of Ceylon, Batak tribal villages in Sumatra, the tropical island of Penang, and ancient temples in Java and Bali.

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The Wages of Sin



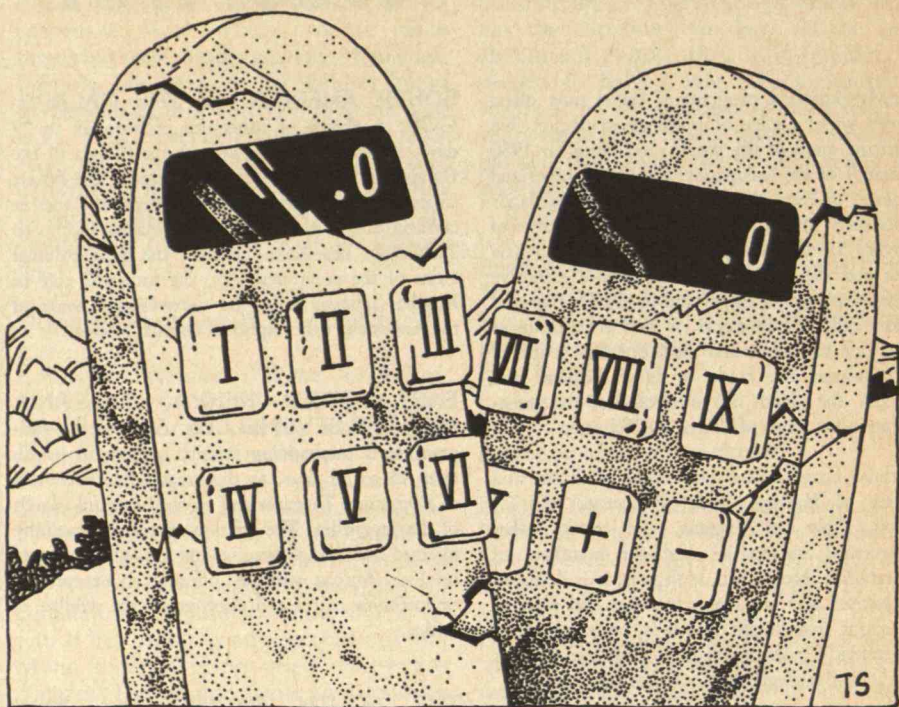
Kenneth E. Boulding is director of the Institute of Behavioral Science and professor of economics at the University of Colorado at Boulder. He is a regular contributor to Technology Review.

The concept of sin, despite attempts to revive it, is still suspect in academic and intellectual circles where refugees from Sunday schools and synagogues constitute a substantial part of the population. In conventional liberal wisdom, only institutions — the family, the school, the business firm, the government — can sin; individuals are merely victims of institutional misdeeds or incompetence.

Where I grew up, in the Methodist working-class culture of Liverpool, the view of the world was very different. Institutions were not seen as unchangeable. After all, in the lifetime of my blacksmith grandfather, suffrage was extended to the working class and then to women, the Labor Party began its rise to power, the trade union movement rose to prominence, and free public education (at least to age 14) and a good deal of social legislation were instituted.

Yet the social change in my grandfather's lifetime — 1860 to 1930 — was perhaps not so great as the technical change. During that time, the rise of the chemical industry, electricity, the automobile, the airplane, the telephone, the telegraph, radio, skyscrapers — virtually all that we think of as the modern world — came into being. Nevertheless, my parents and grandparents viewed both technical and social change as something like the weather. Change came from mysterious sources (such as inventors and governments) not quite as remote as the gods of Olympus but certainly as uncontrollable. I myself, a bright boy good at passing examinations who got into Oxford, was a case in point, though in those days still a rather exceptional one. Even with all the social change and the beginnings of upward mobility, there was still no doubt about who was upper class and who was not.

Most important, however, was sin. Sin was something over which every individual had some control and, more important, responsibility. The Methodist



definition of sin might have been a bit narrow by upper-class standards. This was aptly pointed out by Adam Smith in *The Wealth of Nations*: the poor cannot afford the sins in which the rich indulge, for if they do, they will simply get poorer.

Positive-Sum Decision Makers

We do not have to accept any particular definition or theological origin to see that the concept of sin is important to society. Sociologically, we can define sin as any individual decision that creates a negative-sum situation: that is, one that imposes a greater cost on the rest of us than the benefits received by the decision-maker. It is possible, of course that there is a net cost to the individual making the decision. The individual might not believe this at the time of the decision, though the costs might be realized later. What is important is the net cost to the whole human population. If this cost is positive — that is, if the benefit is negative — then the decision involves sin.

Such a definition is not too far from the Methodist concept. Methodism has certainly produced large numbers of individuals who had positive-sum lives, whose decisions produced net benefits to both themselves and the whole human population. This does not even necessarily involve altruism, though altruism may be an important motivation, especially in a culture that gives a high value to love. It is curious how many discussions of altruism are based on the assumption that the world is at best a zero-sum game — that

when the object of altruism gains, the altruist loses. The enormous importance of the positive-sum decision is often overlooked.

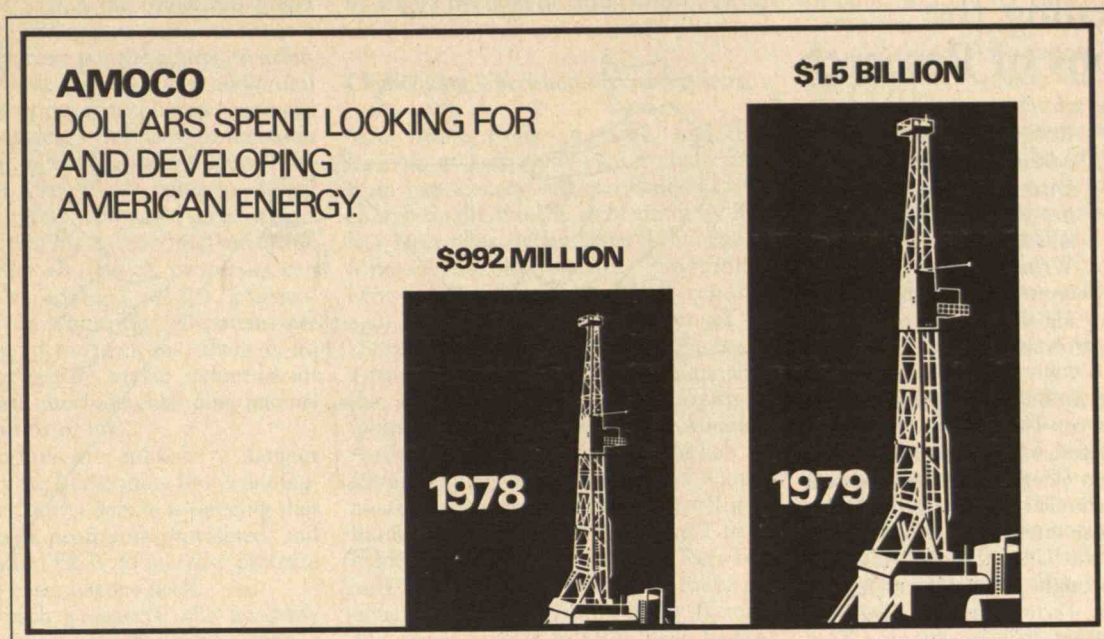
The key to social policy, and indeed to evaluating the whole structure of society, is in the extent to which a policy encourages positive-sum decisions and discourages negative-sum decisions. This may seem like an outrageous statement to those who see social policy only in terms of grants and regulations, and to those who evaluate it in terms of aggregate numerical indices such as the GNP. We are accustomed to thinking of social policy only in terms of the decisions of the powerful — presidents, legislatures, managers, and so on. Nevertheless, the decisions of the "powerless" may well aggregate to a much larger total sum of costs and benefits.

If a society has large numbers of people making high-cost, negative-sum decisions it will go downhill no matter what its political structure or economic policies. If, as Adam Smith also pointed out, large numbers of the population are high-benefit people making positive-sum decisions, the society will be able to survive enormous mistakes in the decisions of the powerful. The question, therefore, is how a society can increase the number of high-benefit people whose sins are relatively minor and cheap, and diminish the number of high-cost people whose sins are costly to the rest of the population.

The legal system seems very ineffective at increasing the number of high-benefit

Continued on page 20

How Amoco spent its money in 1979 finding oil and natural gas in America.



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imported remained nearly the same. Right now, America imports nearly half the oil it uses. The only real answer to excessive foreign oil imports—and the damage this causes to America's economy—is to find and develop more American energy.

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Our country's energy problem is still with us. It's a fact that conventional oil and natural gas will remain our country's primary fuels into the next century... but known reserves are being used up. We plan to spend even more in 1980 to drill more wells and make more progress in synthetic fuel development. We are going to do our best to help get you the energy you need.

America runs better on American oil.



Broadening the Horizons of Research



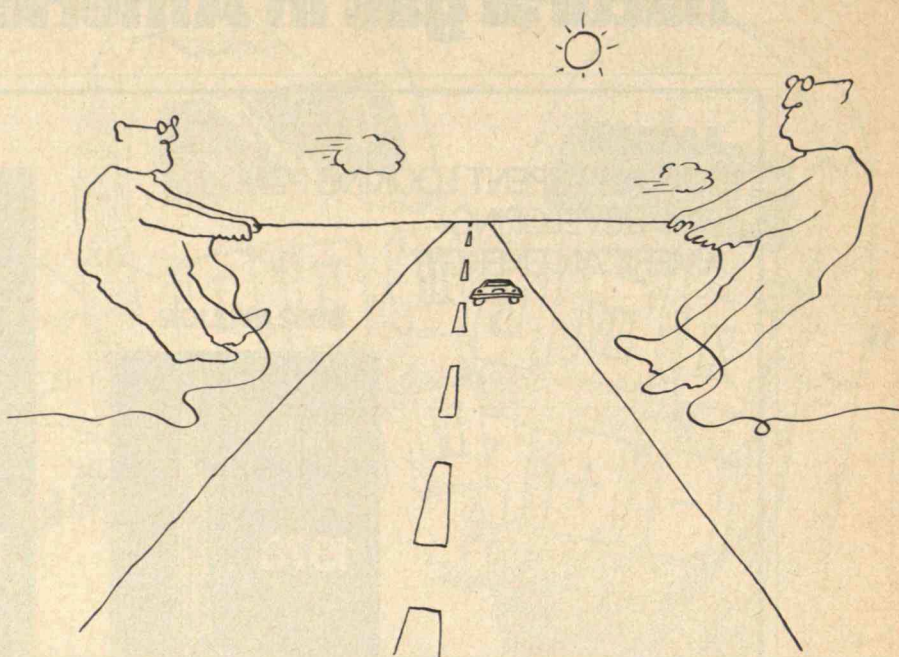
Robert C. Cowen, science editor of the *Christian Science Monitor*, is former president of the National Association of Science Writers and is a regular contributor to the Review. He holds S.B. and S.M. degrees in meteorology from M.I.T.

When Vannevar Bush wrote his seminal report, "Science: The Endless Frontier," over three decades ago, there was little question about whether or to what extent that frontier should be penetrated. What a difference those intervening decades have made! When the (U.S.) National Academy of Sciences brought out its recent report, "Science and Technology: A Five-Year Outlook," it met such questioning head on.

The frontier itself has expanded enormously. "Our view of the universe now ranges outward to the galaxies, back in time to the origin of life and of the universe, and inward to the nucleus of the atom and the molecular basis of heredity," the academy observes. But the pursuit of this knowledge as a noble and rewarding enterprise for humankind no longer is taken for granted. Issues of technological risk and safety, relevance to human needs, and even the propriety of some lines of research, such as the genetics of intelligence — that came stridently forward in the 1970s seem likely to command even more attention in the 1980s.

Aware that an undercurrent of public concern leans toward regulation of research — a current that carries some scientists with it — the academy notes in introducing its report: "The regulation of actions that may be harmful is a proper and necessary function of society. Quite a different issue is raised, however, by the assertion that the creation of knowledge should be controlled because knowledge can be used for good and ill. The possible applications of new knowledge are so varied and unpredictable as to preclude the capacity to foresee net harm." That may be true, but it doesn't stop some critics from imagining future harm and trying to hobble research out of fear.

This was a major driving force behind the political action to regulate recombinant DNA research. The fears that dangerous test-tube chimeras would be un-



Michael Crawford

leashed on the public have proven groundless. But the concern is raised anew by the rapid growth of the biotechnology industry — the new biology is moving out of the laboratory and into the factory far faster than anticipated. As Brian Hartley of Imperial College, London, said in reviewing this development in *Nature*, "Five years ago, even optimists would have predicted that it would be a decade before genetic engineering could be commercially exploited, but this is about to be disproved."

Breeding Bacteria for Profit

In Britain and Europe, Japan, the United States, and the Soviet Union the race is on to profit from what promises to be a major new industry. Bacteria can be bred and given the genetic instructions for making valuable chemicals. Bacterial synthesis of one of the most "golden" of such chemicals — interferon, an antiviral agent expected to be a major drug — has just been reported by a new company, Biogen. That company aced out such giants as Searle Laboratories and DuPont that are also racing to make interferon.

Bacteria can also be induced to "super-produce" industrially useful enzymes, secreting them into the working medium. Alternatively, in what seems the most "futuristic" aspect of this new field, the bacteria themselves or the chemical-producing organelles within them can be isolated and fixed on a substrate so that they do their thing as just another part of the industrial machinery.

This rapid progress has encouraged those geneticists who dream of giving major crops, such as maize and wheat, the ability to fix nitrogen as legumes do. Within five years, it may be clear whether this dream can become a reality.

Meanwhile, critics who worried about monstrosities escaping from academic laboratories have their concerns magnified as the biotechnological industry takes off. It is not just a question of how to regulate this untidy, multinational industry to ensure adherence to safety standards. It is also a question of whether, in principle, the contents of the vats can be adequately monitored. K. Sargeant and C.G. Evans of Britain's Microbiological Research Establishment (a former biological warfare unit) point out in a report to the European Economic Commission that mutant strains of organisms could become established unbeknownst to anyone. Without overstressing what, at this point, is a speculative hazard, they say, "If a contaminant arose that was able to maintain itself . . . then no guarantee concerning either the safety of the process or the culture could be given."

The rise of this new industry also amplifies concern about the hubris of genetic tinkering. Where the academic researchers were accused of trying to play God, the industrial genetic engineers are accused of trying to take out patents on life and the evolutionary process itself. Thus the decision of the (U.S.) Court of Customs and Patent Appeals to grant two applications for patents on novel microbes has been taken to the Supreme Court. The solicitor

general says that living organisms aren't covered by existing patent law and that it is up to Congress, not the courts, to arbitrate such a wide-ranging social and moral issue. Supporting the solicitor general's action, the People's Business Commission (a Washington, D.C., research group) observes that: "To justify patenting living organisms, those who seek such patents must argue that life has no 'vital' or sacred property, that all of life's properties can ultimately be reduced to the 'physico-chemical.'" It also notes: "If patents are granted on microorganisms, there is no scientific or legally viable definition of 'life' that will preclude extending patents to higher forms of life."

Such concerns are unlikely to hamper significantly the burgeoning biotechnological industry. But a debate is opening that promises to be profound, protracted, and emotional, and likely to increase pressure to regulate basic science itself.

Sensing such prospects, the academy explained in its report: "In contrast to the risks inherent in carrying out research, there is the risk that the knowledge produced by research may be used for harm as well as good. Since virtually any knowledge is double-edged, and since its consequences cannot be predicted in detail, our society has proceeded wisely, in our view, in the belief that *on balance* knowledge is less likely to be dangerous than ignorance. Our society is trying to assess and to regulate harmful technological applications before damage occurs, but has declined to regulate research on the basis of speculations about possibly harmful applications."

Research directly affecting people can become an even more emotionally explosive issue — as in the case of the genetics of intelligence — and can raise awkward questions about inherent differences among different groups and races. Here, even a number of scientists have suggested ruling such research out of bounds. Well aware of this challenge, the academy commented: "Still other types of new biological understanding raise fears that deeper insights into human nature might imperil a just and decent society . . . But human curiosity cannot be extinguished, nor can the scientific method be unlearned. Someone will learn, somewhere, sometime. Moreover, the realities will be there, whether or not scientists are permitted to find them; and if we build social policies on false assumptions that contradict reality, we will be building on a crumbling foundation. A democratic and open society, therefore, has no choice but

to defend freedom of inquiry, just as it defends freedom of expression."

Challenging Cherished Preconceptions

You would think that this had been learned, at least by Western civilization, from experiences such as Galileo's. The church finally did the right thing by him, last December, when Pope John Paul II forgave him for pushing Copernican heresy some three and a half centuries ago. However, the oppression of the church never did suppress the heresy, as astronomer-historian Owen Gingerich of the Harvard-Smithsonian Astrophysical Observatory recently told the American Astronomical Society. Dr. Gingerich has examined surviving copies of Copernicus's great book. Although the Roman Inquisition ordered "corrections" to be made, this censorship seems to have been only 60 per cent effective in Italy, and none of the copies from nearby Portugal and Spain appear to have been altered. The authority of dogma, challenged by an unwelcome new concept, was unable to defeat that concept because it was truly scientific — that is, it was founded on reliable data and embodied in a theory capable of predictions that could be verified by observation. This lesson seems to have been forgotten by those who today would eliminate certain lines of research that challenge cherished preconceptions.

The academy is right to emphasize the need to remember this lesson. The issue of what basic scientific research is all about is certain to be central to science policymaking in the 1980s in one form or another, even if not always explicitly stated. Concern over regulation and the "proper" limits of inquiry is one aspect of the issue. Equally important is the question of relevance. How important is it to capture and analyze the radiations from distant galaxies when the biggest unknown facing millions of people today is how to find enough to eat?

Stated that way, the issue sounds like the old query of those who can't see the connection between advancing basic knowledge and advancing technology. (And it merits the tired retort: "What good is a baby?") But the question of relevance has a different thrust these days. It asks how long the scientific enterprise can be reserved for the "rich" — meaning industrialized nations and the well-off elites that sit on top of developing societies. It asks how long part of humanity can continue to reach out for knowledge without finding an effective way to include the rest

of humankind in the enterprise.

William D. Carey, executive officer of the American Association for the Advancement of Science, has expressed it eloquently in commenting on last year's United Nations Conference on Science and Technology for Development. Seeing through the abusive rhetoric and unrealistic demands for technological giveaways by the industrialized nations, Mr. Carey (writing in *Science*) says: "Although the Vienna meeting with its thousands of participants did not display the exquisite diplomatic theater that scientists thought they might find in the city of Metternick, it mirrored powerfully the rising turmoil in the relationships between the struggling human majority and the preoccupied minority. The message from the developing nations was explicit: that they would no longer accept the trickle-down method of scientific and technological transfer that suits the advanced countries . . .

"... They also bracketed the superpowers — capitalist and socialist alike — as equally to blame for diverting scientific and technical expertise into a mindless arms race. It was an indictment with telling effect. As almost nothing else could, it etched the contradictions in the main trends of current history: surging self-consciousness on the part of the emerging majority, contrasted with a rush to the edge of night by the superpowers. The limits of knowledge in managing peaceful change have seldom seemed so clear."

Thus, the exploration of "the endless frontier" that once seemed the manifest destiny of Western civilization is raising fears within that civilization. At the same time, the bulk of humankind suspects it to be but another tool of industrial exploitation. There is danger here of losing the true purpose of basic science, well defined by physicist John Ziman of the University of Bristol, England: "... We must not neglect the spiritual needs to which science caters. Human curiosity about the world in which we live is not an unreal psychological force. The need to find out about things should not be discounted . . ." Beyond the quest for practical payoffs, the demands of national defense, and the pressures to get grants and gain tenure, there is a need for those who carry out the scientific enterprise to join with the rest of us and reestablish, on the basis of our common humanity, the validity of the enterprise as an avenue of advancement for all humankind. After all, that's what Galileo's martyrdom was all about. □

Test-Tube Babies: Solution or Problem?



Ruth Hubbard is professor of biology at Harvard University. She is coeditor of *Women Look at Biology Looking at Women* (Schenkman, 1979) and *Genes and Gender II: Pitfalls in Research on Sex and Gender* (Gordian Press, 1979). This essay is adapted from a talk she gave at the annual meeting of the American Association for the Advancement of Science in January, 1980 reporting work supported by the National Science Foundation.

In vitro fertilization of human eggs and the implantation of early embryos into women's wombs are new biotechnologies that may enable some women to bear children who have hitherto been unable to do so. In that sense, it may solve their particular infertility problems. On the other hand, this technology poses unpredictable hazards since it intervenes in the process of fertilization, in the first cell divisions of the fertilized egg, and in the implantation of the embryo into the uterus. At present we have no way to assess in what ways and to what extent these interventions may affect the women or the babies they acquire by this procedure. Since the use of the technology is only just beginning, the financial and technical investments it represents are still modest. It is therefore important that we, as a society, seriously consider the wisdom of implementing and developing it further.

According to present estimates, about 10 million Americans are infertile by the definition that they have tried for at least a year to achieve pregnancy without conceiving or carrying a pregnancy to a live birth. In about a third of infertile couples, the incapacity rests with the woman only, and for about a third of these women the problem is localized in the fallopian tubes (the organs that normally propel an egg from the ovary to the uterus or womb). These short, delicate tubes are easily blocked by infection or disease. Nowadays the most common causes of blocked tubes are inflammations of the uterine lining brought on by IUDs, pelvic inflammatory disease, or gonorrhea. Once blocked, the tubes are difficult to reopen or replace, and doctors presently claim only a one-in-three success rate in correct-

ing the problem. Thus, of the 10 million infertile people in the country, about 600 thousand (or 6 per cent) could perhaps be helped to pregnancy by in vitro fertilization. (These numbers are from Barbara Eck Menning's *Infertility: A Guide for the Childless Couple*, Prentice-Hall, 1977. Ms. Menning is executive director of Resolve, a national, nonprofit counseling service for infertile couples located in Belmont, Mass.)

Louise Brown, born in England in July, 1978, is the first person claimed to have been conceived in vitro. Since then, two other babies conceived outside the mother are said to have been born — one in England, the other in India. In none of these cases have the procedures by which the eggs were obtained from the woman's ovary, fertilized, stored until implantation, and finally implanted in her uterus been described in any detail. However, we can deduce the procedures from animal experimentation and the brief published accounts about the three babies.

The woman who is a candidate for in vitro fertilization has her hormone levels monitored to determine when she is about to ovulate. She is then admitted to the hospital and the egg is collected in the following way: a small cut is made in her abdomen; a metal tube containing an optical arrangement that allows the surgeon to see the ovaries and a narrow-bore tube (called a micropipette) are inserted through the cut; and the egg is removed shortly before it would normally be shed

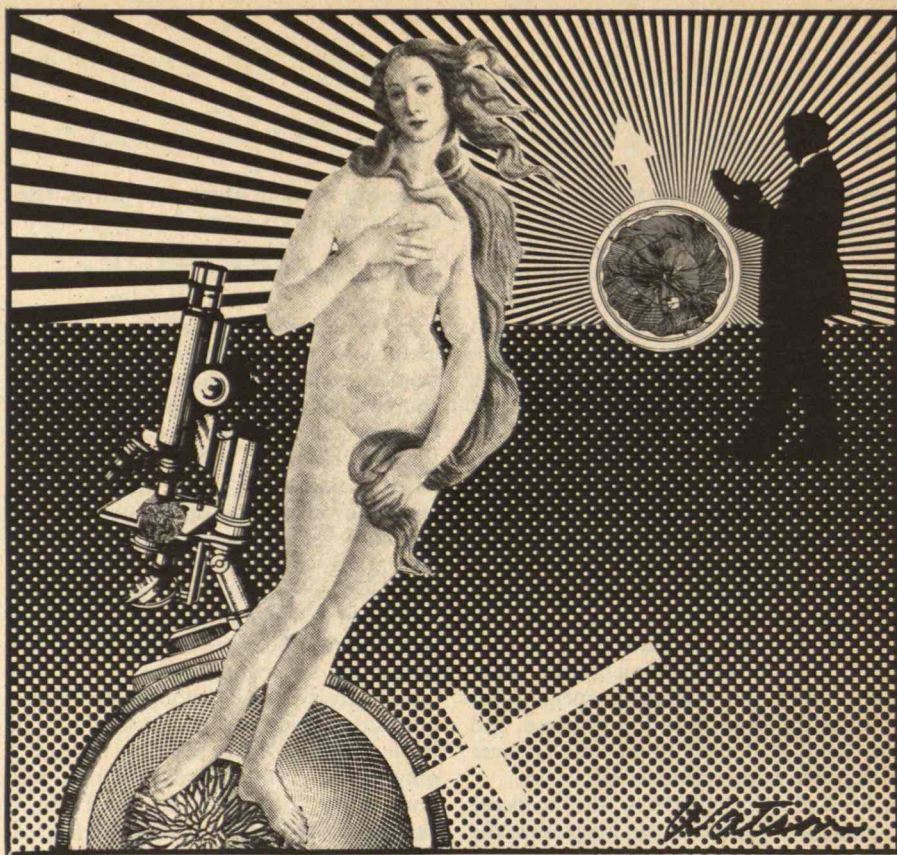
from the ovary. The woman is ready to go home within a day, at most.

When the procedure was first developed, women were sometimes given hormones to make them "superovulate" — produce more than one egg (the usual number for most women). But we do not know whether this happened with the mothers of the three "test-tube" babies that have been born. Incidentally, this superovulation reportedly is no longer induced, partly because some people believe it is too risky.

After the egg has been isolated, it is put into a solution that keeps it alive and nourishes it, and is mixed with sperm. Once fertilized, it is allowed to go through a few cell divisions and so begin its embryonic development — the still-mysterious process by which a fertilized egg becomes a baby. The embryo is then picked up with another fine tube, inserted through the woman's cervix, and flushed into the uterus.

If the uterus is not at the proper stage to allow for implantation (approximately 17 to 23 days after the onset of each menstruation) when the embryo is ready to be implanted, the embryo must be frozen and stored until the time is right in a subsequent menstrual cycle. Again, we do not know whether the embryos were frozen and stored prior to implantation with the two British babies; we are told that the Indian one was.

In sum, then, there is a need, and there is a technology said to meet that need. But



Karen Watson

as a woman, a feminist, and a biologist, I am opposed to using it and developing it further.

Health Risks

As a society, we do not have a very good track record in anticipating the problems that can arise from technological interventions in complicated biological systems. Our physical models are too simpleminded and have led to many unforeseen problems in the areas of pest control, waste disposal, and other aspects of what is usually referred to as the ecological crisis.

In reproductive biology, the nature of the many interacting processes is poorly understood. We are in no position to enumerate or describe the many reactions that must occur at just the right times during the early stages of embryonic development when the fertilized egg begins to divide into increasing numbers of cells, implants itself in the uterus, and establishes the pattern for the different organ systems that will allow it to develop into a normal fetus and baby.

The safety of this *in vitro* procedure cannot be established in animal experiments because the details and requirements of normal embryonic development are different for different kinds of animals. Nor are the criteria of "normalcy" the same for animals and for people. The guinea pigs of the research and implementation of *in vitro* fertilization will be:

- The women who donate their eggs.
- The women who lend their wombs (who, of course, need not be the same as the egg-donors; rent-a-wombs clearly are an option), and
- The children who are produced.

The greatest ethical and practical questions arise with regard to the children. They cannot consent to be produced, and we cannot know what hazards their production entails until enough have lived out their lives to allow for statistical analysis of their medical histories.

This example shows the inadequacy of our scientific models because it is not obvious how to provide "controls," in the usual scientific sense of the term, for the first generation of "test-tube" individuals; they will be viewed as "special" at every critical juncture in their lives. When I ask myself whether I would want to be a "test-tube person," I know that I would not like to have to add *those* self-doubts to my more ordinary repertory of insecurities.

A concrete example of a misjudgment

Sowing the Seeds of Genius

by Robert Cooke

There is an ultraselect sperm bank in Southern California, the brainchild, as it were, of a California businessman named Robert K. Graham. And its donors are winners of the Nobel Prize in science.

Despite some hilarity at this end of the country, the new sperm bank is apparently serious business for Graham. According to recently published reports, the sperm bank has already supplied sperm for three women, and Graham has tapped at least four Nobel Prize-winning scientists for sperm donations.

The only scientist who admits having donated to Graham's sperm bank is Stanford University's controversial William B. Shockley, 70, who said in a *Los Angeles Times* interview he's disappointed that more of his fellow Nobel winners haven't agreed to donate.

Graham, 74, said he is merely carrying on the dream of 1946 Nobel Prize-winning geneticist Hermann Muller. Muller advocated establishing sperm banks in which donations from brilliant men would be stored until after their deaths. Later, carefully selected women who wished to increase their chances of producing exceptionally bright children would receive the sperm. Muller's ideas were bitterly attacked at the time, and he died a disappointed man.

Much of the opposition to the idea, scientists explain, stems from the fact

that it probably won't work, because not enough is yet known about how geniuses are produced. Indeed, a fundamental, often bitter argument is now underway among scientists over whether heredity has much to do with intelligence. "There's no reason to think that individuals born as a result of use of this sperm bank will have any greater chance of being geniuses than anyone else in the world. I think it's ridiculous," said Dr. Jonathan Beckwith, professor of microbiology and molecular genetics at the Harvard School of Medicine.

Graham, who lives in Escondido, Calif., said the women who get the sperm need pay only shipping costs, plus a refundable deposit on the container used to keep the sperm frozen.

An M.I.T. scientist (who asked not to be identified) commented, however, that "it could be a clever confidence game. If people believe they're getting real genius seeds, perhaps the price could go up beyond \$10,000."

Biologist George Wald of Harvard, who won the Nobel Prize in 1967, commented: "Oh, this is a crushing blow, to be left out of this sperm bank. I felt bad enough when I only made it into President Nixon's second enemies list." Wald added that "I hope Graham has checked out the sperms' motility if he's starting at Shockley's age level," because the sperm from older men are often unable to "swim" as vigorously as the sperm from young men.

Robert Cooke is the science editor of the Boston Globe. This article is reprinted with permission (copyright 1980, the Boston Globe).

with an unfortunate outcome that could not be predicted was the administration of the chemical thalidomide, a "harmless tranquilizer" touted as a godsend and prescribed to pregnant women, which resulted in the births of thousands of armless and legless babies. Yet there the damage was visible at birth and the practice could be stopped, though not until after it had caused great misery. But take the case of the hormone DES (diethyl stilbesterol), which was prescribed for pregnant women in the mistaken (though at the time honest) belief that it could prevent miscarriages. Some 15 years passed before many of the daughters of these women

developed an unusual form of vaginal cancer. Both these chemicals produced otherwise rare diseases, so the damage was easy to detect and its causes could be sought. Had the chemicals produced more common symptoms, it would have been much more difficult to detect the damage and to pinpoint which drugs were harmful.

The important point is that both thalidomide and DES changed the environment in which these babies developed — in ways that could not have been foreseen and that we still do not understand. This happened because we know very little about how embryos develop. How

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then can we claim to know that the many chemical and mechanical manipulations of eggs, sperms, and embryos that take place during in vitro fertilization and implantation are harmless?

A Woman's Right?

The push toward this technology reinforces the view, all too prevalent in our society, that women's lives are unfulfilled, or indeed worthless, unless we bear children. I understand the wish to have children, though I also know many people — women and men — who lead happy and fulfilled lives without them. But even if one urgently wants a child, why must it be biologically one's own? It is not worth opening the hornet's nest of reproductive technology for the privilege of having one's child derive from one's own egg or sperm. Foster and adoptive parents are much needed for the world's homeless children. Why not try to change the American and international practices that make it difficult for people who want children to be brought together with children who need parents?

Advocates of this new technology argue that every woman has a right to bear a child and that the technology will extend this right to a group previously denied it. It is important to examine this argument and to ask in what sense women have a "right" to bear children. In our culture, many women are taught from childhood that we must do without lots of things we want — electric trains, baseball mitts, perhaps later an expensive education or a well-paying job. We are also taught to submit to all sorts of social restrictions and physical dangers — we cannot go out alone at night, we allow ourselves to be made self-conscious at the corner drugstore and to be molested by strangers or bosses or family members without punching them as our brothers might do. We are led to believe that we must put up with all this — and without grouching — because as women we have something beside which everything else pales, something that will make up for everything: we can have babies! To grow up paying all the way and then to be denied that child is a promise unfulfilled; that's cheating.

But I would argue that to promise children to women by means of an untested technology — that is being tested only as it is used on them and their babies — is adding yet another wrong to the burdens of our socialization. Take the women whose fallopian tubes have been damaged by an infection provoked by faulty IUDs.

They are now led to believe that the problems caused by one risky, though medically approved and administered, technology can be relieved by another, much more invasive and hazardous technology.

I am also concerned about the extremely complicated nature of the technology. It involves many steps, is hard to demystify, and requires highly skilled professionals. There is no way to put control over this technology into the hands of the women who are going to be exposed to it. On the contrary, it will make women and their babies more dependent than ever upon a high-technology, super-professionalized medical system. The women and their babies must be monitored from before conception until birth, and the children will have to be observed all their lives. Furthermore, the pregnancy-monitoring technologies themselves involve hazard. From the start, women are locked into subservience to the medical establishment in a way that I find impossible to interpret as an increase in reproductive freedom, rights, or choices.

Health Priorities

The final issue — and a major one — is that this technology is expensive. It requires prolonged experimentation, sophisticated professionals, and costly equipment. It will distort our health priorities and funnel scarce resources into a questionable effort. The case of the Indian baby is a stark illustration, for in that country, where many children are dying from the effects of malnutrition and poor people have been forcibly sterilized, expensive technologies are being pioneered to enable a relatively small number of well-to-do people to have their own babies.

In the United States as well, many people have less-than-adequate access to such essential health resources as decent jobs, food and housing, and medical care when they need it. And here, too, poor women have been and are still being forcibly sterilized and otherwise coerced into *not* having babies, while women who can pay high prices will become guinea pigs in the risky technology of in vitro fertilization.

In vitro fertilization is expensive and unnecessary in comparison with many pressing social needs, including those of children who need homes. We must find better and less risky solutions for women who want to parent but cannot bear children of their own. □

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Fact:

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Mile for mile and pound for pound, today's freight railroads are up to four times more fuel-efficient than big trucks. Shippers recognize this advantage. That's why piggybacking truck trailers and containers is the fastest-growing segment of the rail freight business.

But there's another consideration. While every wage-earner and manufacturer in America subsidizes our public highway system, trucks are destroying that vital system at an alarming rate.

Congress' watchdog, the General Accounting Office, said in a blistering July 1979 report: "Excessive truck weight is a major cause of highway damage. The rate of highway deterioration will slow down if excessively heavy trucks are kept off the highways... A five-axle tractor-trailer loaded to the current 80,000 pound federal weight limit... has the same impact on an interstate highway as at least 9,600 automobiles."

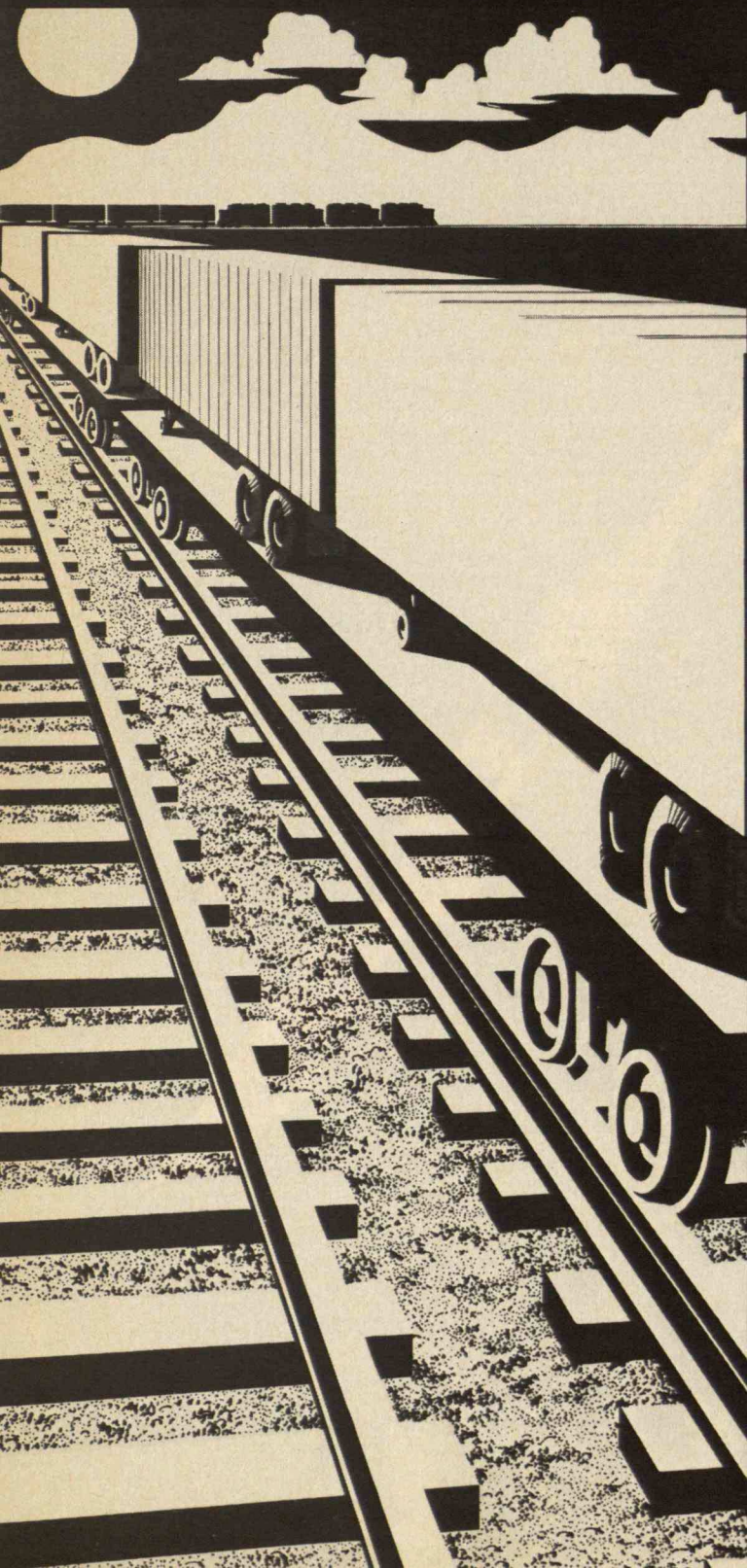
It is ironic that the American public is subsidizing the destruction of its own highways. It is also unnecessary, because a logical alternative already exists. This is the vast, fuel-efficient steel network that links every part of America: our modern freight railroads.

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The Center is devoted exclusively to manufacturing research.

Here, a highly trained team of scientists and engineers probe fundamental questions about materials and processes. They provide Western Electric factories with pre-tested,



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For example, while Bell Labs scientists were inventing new glass fibers, Western Electric engineers and scientists were tackling the manufacturing problems involved.

The fibers had to be drawn from molten glass at high speeds, with less than a 1% deviation in diameter.

But how do you control a "thread" of glass being spun at rates up to 15 feet per second?

Scientists and engineers at the Center discovered that laser light beamed onto the fiber cast a characteristic pattern.

By correlating the pattern to the fiber's diameter, they were able to build a monitoring system into the fiber drawing machinery. It measures the fiber 1000 times per second, automatically adjusting production to keep the diameter constant.

The system works so well that in all the miles of fiber produced by Western Electric, the diameter varies by no more than 30-millionths of an inch.

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And Western Electric's Engineering Research Center is an essential link between the ideas of the laboratory and the realities of the factory.

So your Bell Telephone Company can make the best one-of-a-kind inventions a part of your phone service.

Keeping your communications system the best in the world.



Western Electric

The Making of a Demigod

The Right Stuff

Tom Wolfe

Farrar, Straus and Giroux, 1979, 436 pp.; \$12.95

Reviewed by Charles Ball

The three-inch-high headline in the *Boston Traveler* on February 20, 1962, screamed (with an exclamation mark so there would be no misunderstanding) "HE MAKES IT!" The "he" had a certain godliness to it, and in fact the *Traveler's* readers that day — and Americans everywhere — were preparing to worship a new, if temporal, deity. "He" was John Herschel Glenn, Jr., one of the seven Project Mercury astronauts, and he had just become the first American to orbit the earth. That may not seem like much today (and, indeed, it didn't seem like all that much to some people even then), but the five-hour space flight transformed Glenn instantaneously into a national hero of such stature that, as Tom Wolfe tells us in *The Right Stuff*, the mere sight of him was enough to make men and women — even New York City police — weep with gratitude for what he had done. There they were during a ticker-tape parade for Glenn, Wolfe writes, "New York's Finest, big tough-looking men in blue and great-coats — and they were crying! They were right out in the intersections . . . bawling away — tears streaming down their faces."

I remember the public reaction well because I was covering aviation and space for the *Traveler*. And while it seemed reasonable that the country should be excited about Glenn's three-orbit flight in *Friendship 7*, his elevation to secular savior seemed excessive, especially since Russian cosmonaut Yuri Gagarin had become the first human to orbit the earth on April 12, 1961, and cosmonaut Gherman Titov had completed 17 orbits on August 6, 1961, nearly seven months before Glenn's mission.

That was just the point, however, according to Wolfe. The American public had been fearful and panicky about the Soviet Union's victories in the new battlefield of space ever since *Sputnik 1* became the world's first artificial satellite in 1957. And now here were these brave American lads rising into the heavens — atop rockets that always seemed ready to

HE MAKES IT!

Glenn: 'That Was A Real Fireball'



CAPE CANAVERAL, Fla. — Astronaut John H. Glenn Jr. flew three times around the world in 281 minutes today and splashed to a safe landing in the Atlantic.

"Boy, that was a real fireball," the jaunty Marine reported by radio as his spaceship absorbed temperatures up to 2,800 degrees in its dive back through the atmosphere.

He added to tell "fins." Recovery forces sighted them at 2:46 p.m. while they were still in the air.

Glenn splashed down in the Atlantic 800 miles southeast of Cape Canaveral at 2:52 p.m.

At 2:58 p.m., 4 hours and 41 minutes later, he had completed the three orbits of his mission.

The minutes later, his spacecraft's 62-foot main

parachute opened at 51,000 feet and dropped the craft and its pilot into the sea.

Glenn's total time in the sky from launch to splash down was completed at 4 hours and 41 minutes.

Glenn reported, "My condition is excellent. I was still seated in the capsule, but kept no radio communications."

At 3:01 p.m., the destroyer New Jibbered for



Family 'Relieved And Overjoyed'

blow up or fizzle out — to challenge the cold war enemy in the nearly forgotten tradition of "single combat" warriors.

"Just as the Soviet success in putting *Sputniks* into orbit . . . revived long-buried superstitions about the power of heavenly bodies and fear of hostile control of the heavens," Wolfe writes, "so did the creation of the astronauts and a 'manned space program' bring back to life one of the ancient superstitions of warfare . . . In single combat the mightiest soldier of one army would fight the mightiest soldier of the other army as a substitute for a pitched battle between the entire forces . . ."

The public, spurred by adoring media, lionized all seven astronauts — Glenn, Scott Carpenter, Gordon Cooper, Gus Grissom, Wally Schirra, Al Shepard and Deke Slayton — from the time of their first press conference. And Shepard received a hero's welcome after his suborbital flight on May 5, 1961. But Glenn was the first to stake out a territorial claim in the dark void previously only the Russians had flown. And the emotional dam burst for him in what Wolfe describes as "the greatest surge of patriotism since World War II."

The Best Engineering Money Could Buy

He'll get no argument from me. At a dinner party shortly after Glenn's hour of triumph, I dared to suggest that it was ab-

surd to compare his achievement, backed as it was by the best engineering the national treasury could buy, with Charles Lindbergh's one-on-one battle against the Atlantic in his solo flight from New York to Paris 25 years before. I was nearly run out of the house.

The Mercury astronauts made six flights, starting with Shepard's "little mortar lob" with its five minutes of weightlessness and ending with Cooper's 22-orbit flight on May 15, 1963. Wolfe draws on months of interviews and research to recreate the missions, mistakes and all, and to get inside the heads and even the bodies of the astronauts (Shepard had to urinate in the worst way — and did) in a book full of wit and wisdom.

The point must be made that *The Right Stuff* isn't only, or even primarily, about Project Mercury or the astronauts. Everything that happened, Wolfe believes, has to be understood in the context of what it means to be a fighter/combant/test pilot imbued with the "right stuff."

Pilots who have it are willing to "hang their hides out over the edge" and fly "in the jaws of the Gulp." They are men who seem more afraid of fouling up, and looking bad in the eyes of their flying brothers, than of dying. They fly hard, drink hard, drive hard in flashy cars, and keep an eagle eye out for women attracted to their kind. (There are exceptions, of course, and Glenn was one; he drove a "terrible-looking" Peugeot and scolded the other

astronauts for womanizing.)

Willingness to face death is only one component of the "right stuff." "The idea seemed to be that any fool could do that [risk his life] ... No, the idea here ... seemed to be that a man should have the moxie, the reflexes, the experience, the coolness, to pull it back in the last yawning moment — and then go up again *the next day* and the next day and every next day ... A career in flying was like climbing one of those ancient Babylonian pyramids made up of a dizzy progression of steps and ledges, a ziggurat, a pyramid extraordinarily high and steep; and the idea was to prove at every foot of the way up that pyramid that you were one of the elected and anointed ones who had *the right stuff* and could move higher and higher and even ... that you might be able to join that very special few at the top, that elite who had the capacity to bring tears to men's eyes, the very Brotherhood of the Right Stuff itself."

Imagine their angst, then, the irony, when the astronauts, the new instant heroes, were at first belittled by the one group whose approval they most wanted — their peers in the test-flying fraternity.

The Right Stuff Wasn't Enough

Pilots such as Chuck Yeager, who stood at the pinnacle of the pyramid, derided the Mercury program as more fit for monkeys than men. (Indeed, a monkey made the first flight.)

The astronauts wouldn't be pilots in control of their destinies, their critics said. They would be like laboratory animals, "wired from skull to rectum with sensors." They were going to plop down in the ocean, for heaven's sake, and be rescued by frogmen. "Spam in a can" was the put-down that came from Edwards Air Force Base in California, where the truest of the true test pilots dwelled.

Some of the astronauts might have walked away from the program there and then. But the Mercury seven had an unbelievably good thing going, Wolfe reports, including a *Life* magazine contract and the promise of other goodies, and they weren't about to give it up. Instead, they changed the image of the program by insisting to the National Aeronautics and Space Administration that the capsules (thereafter to be called spacecraft) be outfitted with windows and that the astronauts be able to override the automatic controls.

As it turned out, Gordon Cooper used the manual cycle to bring his craft down

after the automatic control system malfunctioned, proving the need for a piloting "component" in manned missions. And eventually, in 1963, the Mercury astronauts received the Ivan C. Kinchelow Award, named for a famed test pilot, "for outstanding professional performance in the conduct of flight testing." It was recognition, at last, from their peers.

In much of his previous writing, Wolfe has looked with a mostly jaundiced eye at aspects of the American scene. But he makes few judgments here and finds fault mainly with the American press which "for all its vaunted independence seemed determined that the *proper motion*, the *seemly sentiment*, the *fitting moral tone* should be established and should prevail ... " These attitudes even carried over to its treatment of the astronauts' wives. Wolfe writes that a picture of them in *Life* was so retouched that "every suggestion of a wen, a hickie, an electrolysis line, a furze of mustache, a bag, a bump, a crack in the lipstick, a rogue cilia of hair ... had disappeared."

Tom Wolfe has toned down his flamboyant style a bit for *The Right Stuff*, perhaps adapting himself more to the pace

of Yeager's down-home (Hamlin, W.V.), understated drawl that has become the "voice" of pilots everywhere (listen carefully, Wolfe suggests, the next time your airline captain gets on the intercom). Wolfe is a virtuoso writer whose talent illuminates a significant moment in history. "Not even the first American to walk on the moon would ever know the outpouring of a people's primal emotions" as did the original astronauts and, above all, John Glenn, a single-combat warrior who glowed with the right stuff.

Charles Ball is an assistant director of the M.I.T. News Office. □

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Economy Need Not Be Austere

New Inventions in Low-Cost Solar Heating: 100 Daring Schemes Tried and Untried

William A. Shurcliff

Andover, Mass.: Brick House Publishing Co., 1979, 293 pp.; \$12.00

Reviewed by Robert Jeffries

The challenge is to make the sun do as much as possible in powering our buildings. The solutions range from the sublime to the ridiculous. The ridiculous is epitomized by a solar illumination device, recently featured on the cover of a national magazine, that is complete with a tracking mechanism, somehow implying that windows no longer serve their purpose. The sublime is yet to be seen.

William Shurcliff's designs in *New Inventions in Low-Cost Solar Heating* oc-

cupy the vast middle ground. He falls short of the sublime for a reason that applies to the whole field of solar design: he has an incorrect vision of the energy future. He states that one should "design for tomorrow's austere living conditions, not today's luxurious conditions." To do so is to insure that conditions in the future will be austere. Pessimism rarely fuels the creative fires.

Signs of Economy

With austerity in mind, economies become necessary. Most of Shurcliff's designs rely on manual or semiautomatic controls, binding the occupant to the system. Further economies are gained at the expense of the building's interior. Water-filled drums as walls, insulating shutters at windows (of which there are few except on the south walls), ropes hanging from pulleys, and heavy masonry wherever possible — all are obvious signs of strict economy. It is as if all the progress made in providing for environmental comfort without compromising aesthetics has been forgotten.

And what of aesthetics? The common theme is that we will learn to like austerity. William Shurcliff warns in his introduction that "when the looming energy crises worsens, most people will, I think, regard anything that is nicely suited to keeping the house warm in winter as beautiful. When the going gets tough, beauty and functional excellence become almost synonymous." The idea that a solar heating system that works well is beautiful may help the system's designers but not necessarily those who must live with it.

The problems of aesthetics, economy, and austerity that plague most solar designers have more to do with the form of shelter they choose to work on than with any future scenario they envision. The single-family detached dwelling is seen as the Cadillac of housing. However, the ratio of exposed surface area to living area tends to be very high. In contrast, the townhouse or row house has probably the lowest ratio. The shared walls of such low-rise, multiple-unit buildings suffer no heat losses or gains. A study done in 1975 by the Real Estate Research Corp. demonstrates that solar townhouse developments could achieve overall energy savings above 40 per cent compared with single-family detached solar houses. This means that a solar house will consume almost as much oil, gas, and/or electricity as a nonsolar townhouse. Why then do

designers and government programs still emphasize the single-family home? Changing the American dream of the single-family house may be a crucial step in achieving real energy savings.


Design for Community

A multitude of benefits accrue from using more efficient building types. Multiple units served by one solar heating system have built-in economies. A single set of controls will operate the entire system. A passive solar collector such as a greenhouse or atrium collector can be used to buffer the townhouses from outside conditions. The atrium space is shared and serves to buffer the outdoor climate and thus reduce thermal loads. The atrium can be landscaped, help provide security, and provide a focus for a community of living units. The density of this style of living reduces the need for roads, utilities, and land. Mass transit and car pooling are easier.

This type of planning and designing is not done to accommodate future austerity but rather to stimulate what used to be known as "community." Applying a similar positive design approach to other types of buildings should yield similar results.

Government promotes the single-family dream and has a bias against passive solar systems. Zoning and land-use ordinances often forbid the densities necessary for successful application of solar energy systems. Subsidies in the form of tax rebates and write-offs are given for active, high-technology, high-cost solar energy systems. Passive systems, best applied in high-density buildings, do not benefit because of the difficulty in developing standards and tests for passive systems. If they cannot be labeled, they cannot be subsidized. It is difficult to tell where a passive solar device ends and the building begins. If a masonry wall both supports the building and stores heat, how will the bureaucrat classify it?

What can be done to improve the situation? First, designers of William Shurcliff's talent must be encouraged to devote themselves to more useful forms of construction. Shurcliff's inventions and ideas cover the full range of solar heating systems, active, passive, and hybrid, yet all are aimed at the inefficient single-family detached dwelling. Second, the way the author presents his ideas induces the reader to start making his or her own improvements. This is important: the more informed we all become, the better the chance that productive uses of solar



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energy will become reality. Finally, we must try to prevent the government from giving competitive advantage through various subsidies to certain systems at the expense of others because of preconceptions, myths, and the difficulty of setting standards and performance criteria.

Instead of fearing the future and planning and designing under that fear, we must develop a positive approach. Planning for a future of community, common enterprise, and sharing will give the best result. In such an atmosphere the coming solar age can be seen as a challenge to architects and engineers to find new forms, new materials, and new methods to strengthen the fabric of society. In the final analysis, solutions to the energy crisis will rely less on hardware and more on patterns of living.

Robert Jeffries is an architect with Feldman & Associates in Newton, Mass. He did his thesis on solar energy and has been interested in the problem ever since he attended a passively heated nursery school. □

Boulding/Continued from page 6

people and diminishing the number of high-cost people. Indeed, it would not be surprising if the system turned out to have exactly the opposite impact, especially in increasing the number of high-cost people. There is a good deal of evidence that the legal system reinforces the criminal subculture. The system is itself a high cost to the rest of society (in terms of the brain drain into it), and the point of diminishing returns may have been reached. Legitimizing threats, on which the legal system specializes, may sometimes prevent the expression of motivations, but threats very rarely affect the motivations themselves. For instance, the extremely confusing and contradictory evidence regarding the effect of capital punishment on homicide rates suggests that the fear of punishment is a relatively small factor in determining the motivations for murder. No careful cost-benefit analysis of the legal system has ever been performed; perhaps it would be an impossible task.

A High Priority for the Human Race

In the formation of the motivations of high-benefit people, three institutions have traditionally been regarded as particularly important — the family, the school, and the church. Society tends to

support all these institutions though often in somewhat contradictory ways. In our own society the educational institutions have received the most direct attention. And in spite of the separation of church and state, the tax system subsidizes the institution of the church. The tax system also subsidizes the family, at least to a modest degree, although for the most part only when there are children present. It is difficult to say whether this public support of promoters of altruism makes very much difference. One suspects that the great social changes in all three institutions, especially in the family and the church, take place without much benefit from government, perhaps even without much benefit from the clergy.

I have an uneasy feeling that neither the family, the school, nor the church are adequately fulfilling their function of increasing the proportion of high-benefit people and diminishing the proportion of high-cost people. And these institutions seem even less adept at this than they used to be. It is clear that we know remarkably little about what in the human experience creates either high-benefit or high-cost people, and until we do it will be difficult to prescribe the institutions that foster one and discourage the other. Nevertheless, furthering the understanding of this matter should be a very high priority for the human race, and our failure to understand it is ignorance at very high cost. □

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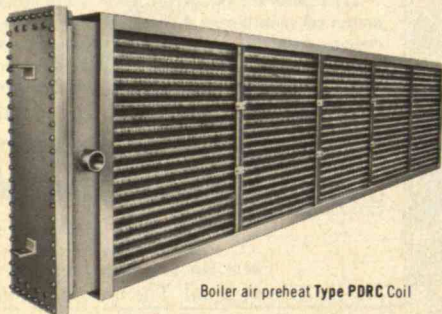
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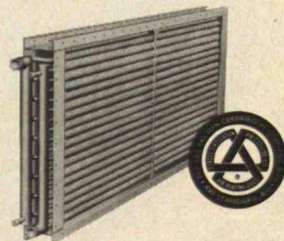
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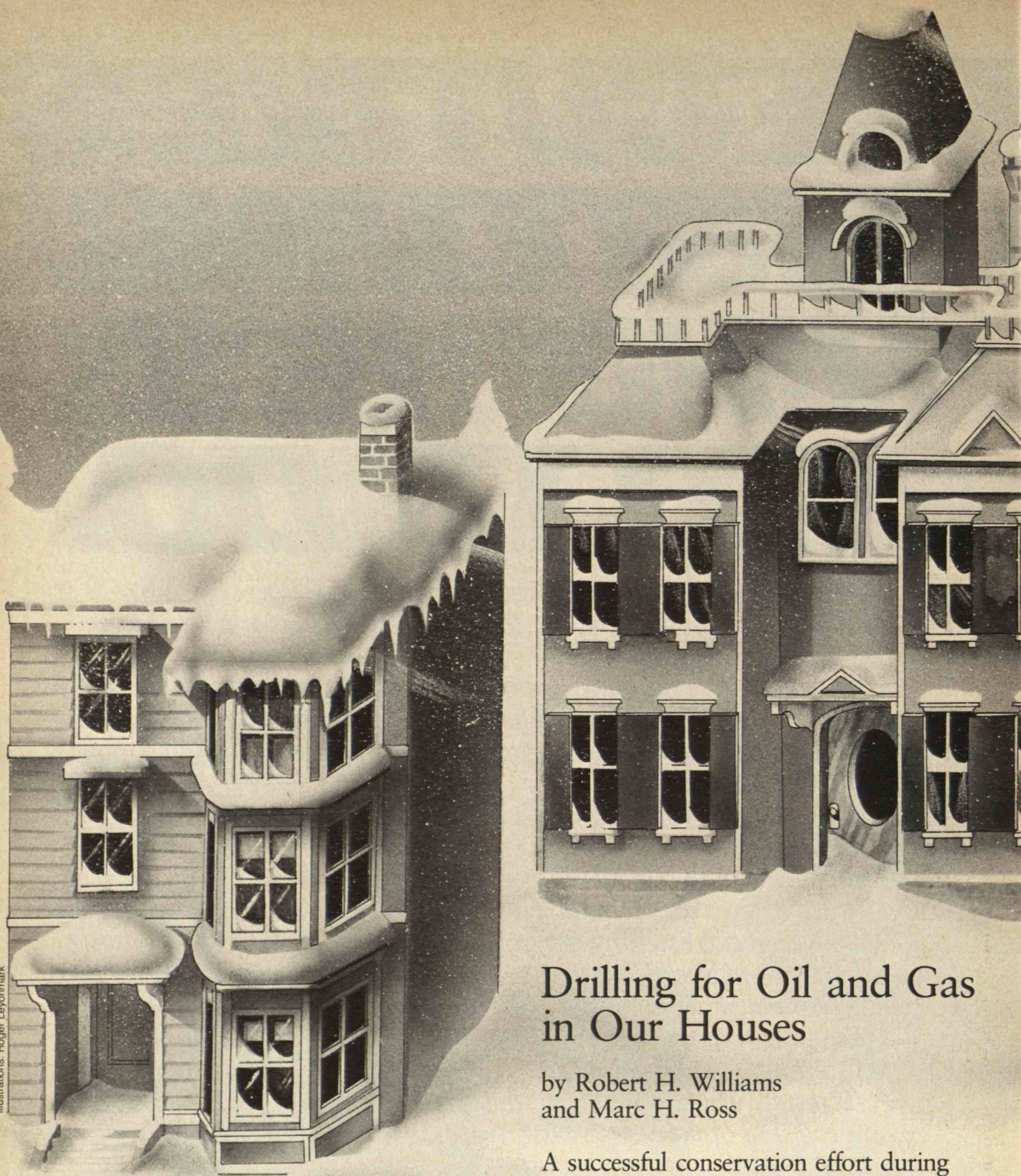


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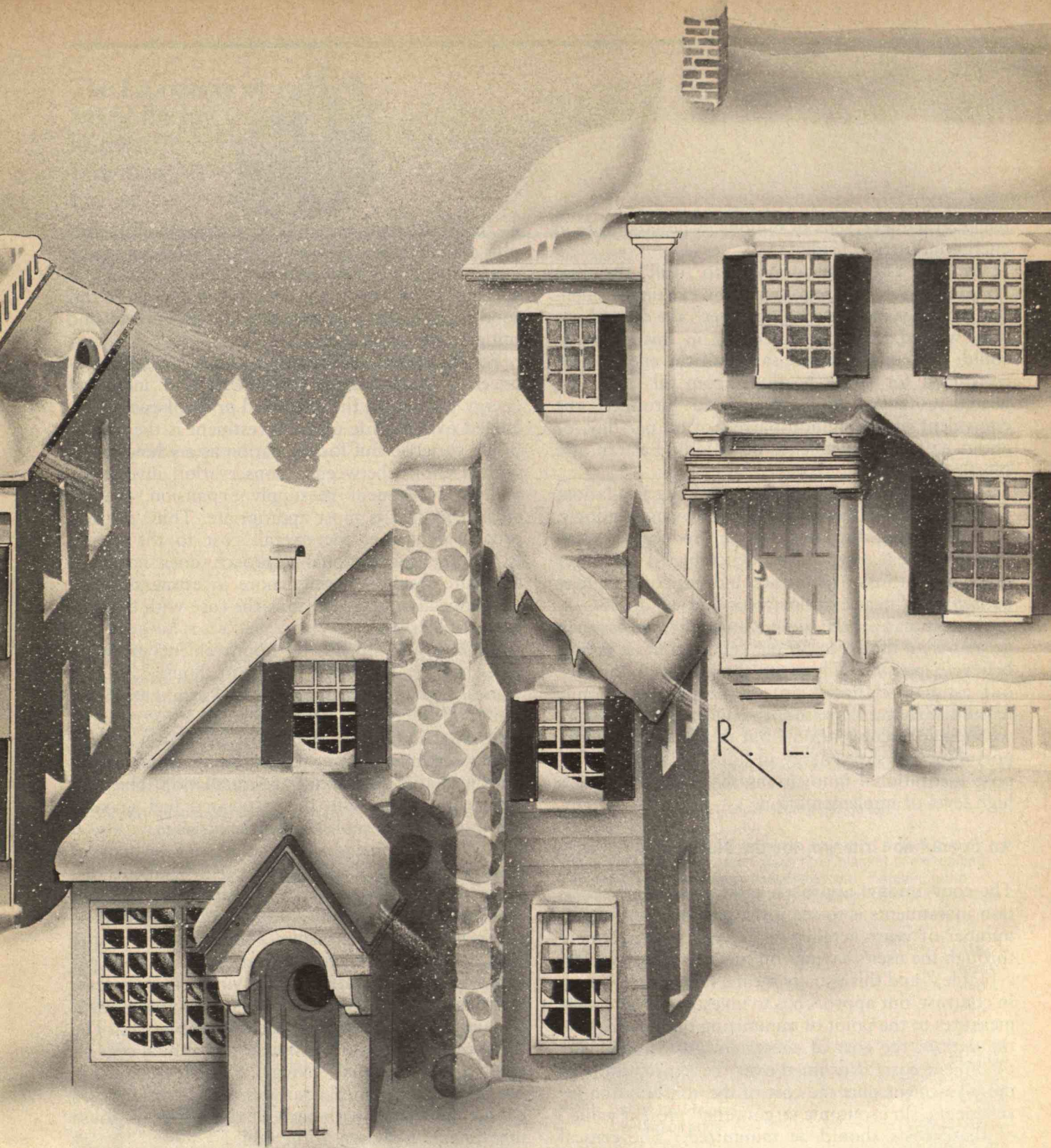
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Drilling for Oil and Gas in Our Houses

by Robert H. Williams
and Marc H. Ross

A successful conservation effort during the 1980s — involving unconventional but relatively simple improvements, innovative financing procedures, and realistic economic criteria — could save half the energy now consumed for space heating.



Over 40 per cent of U.S. oil imports, or nearly 20 per cent of U.S. oil consumption, has been provided by Middle Eastern and North African sources. The vulnerability of these supplies has been dramatized by the political upheaval in Iran, the Soviet actions in Afghanistan, and the 1979 Senate Foreign Relations Committee prediction that Saudi Arabian oil production in 1985 will fall several million barrels per

day below previously expected production levels. Because of these uncertainties about foreign supplies and the difficulties of increasing domestic production, a U.S. oil supply shortfall — measurable in millions of barrels per day — is a very real possibility for the mid 1980s. How can we avert this potential crisis? With gasoline rationing? Further reductions in the speed limit? Mandatory thermostat set-

backs in winter? Tens of billions of dollars more in energy industry subsidies?

We have a different proposal: to “drill” the giant “oil and gas fields” represented by existing residential buildings and thereby “recover” the oil and gas now wasted. A successful effort in this direction could, by the late 1980s, save half the energy now consumed for space heating. From oil- and gas-heated residences alone, this would “produce” the equivalent of 1.6 million barrels of oil per day, or about half our dependence on Middle Eastern and North African oil.

A combination of measures — adding insulation, caulking and weatherstripping, improving windows, and modifying furnaces — can reduce the fuel needed to heat a typical residence by 50 to 75 per cent without loss of comfort. Indeed, comfort may be *improved* near exterior walls and windows.

Our estimate of the fuel savings potential is much greater than the 10 to 30 per cent that most people believe is possible. There are three reasons for this: our estimate is based on a concept of economic feasibility that differs from the one commonly used, we include unconventional but relatively simple opportunities to save energy in housing, and we propose institutional innovations that could lead to a high level of implementation.

An Economic Criterion for the Nation

The conventional approach to evaluating conservation investments is to see if the payback period (the number of years it takes to pay off the investment through the user's savings on fuel purchases) is “acceptable,” and this usually means three to five years. In contrast, our approach is to invest in conservation measures to the point of minimizing the total cost to the *nation*: the cost of energy (evaluated at its replacement cost) consumed over the expected life of the investment plus the cost of the conservation investments. (In economic jargon, the “present value” of these costs should be minimized.) The critical terms here are “expected life” and “replacement cost.” The expected life of most conservation investments is more than three to five years, so by our criterion fuel savings are credited for a longer period. Moreover, fuel savings are also credited at a higher value in our approach, since the replacement cost pertains to energy from new sources and facilities — the costs of which will be significantly higher than present energy prices. Here the replacement cost is meant to be the *total* replacement cost

— the direct replacement cost (the production cost) plus an increment to cover external social costs (e.g., environmental risks, national security risks). A societal commitment to value saved energy at this total replacement cost would help “internalize” and mitigate the externalities.

For the individual consumer who must choose between a conservation investment and increased energy purchases, the estimated *price* of energy averaged over the life of the investment is the appropriate variable. But for the nation as a whole, faced with a choice between a conservation investment and an investment in supply expansion, the *replacement cost* is most appropriate. Thus, our approach minimizes the overall cost to the nation (while the conventional approach does not) and therefore results in many more investments being economically justified than is the case with conventional analysis.

To illustrate, consider the improvements in energy efficiency made in the Bowman house, a large wood-frame rambler in suburban Washington, D.C. This house was thermally tightened by a research team at the National Bureau of Standards. Investments were made in storm windows, wall insulation, floor insulation, and extra attic insulation. These investments, along with the associated fuel savings, are shown in the table on the facing page.

It is useful to introduce the concept of the “cost of saved energy” associated with these investments (using constant 1978 dollars). Consider the \$780 investment in storm windows for the Bowman house — an investment that saves 248 gallons of oil per year. If this investment were paid for with a 12 per cent home-improvement loan having a 15-year term (comparable to the expected life of the investment), the average annual loan payment would be \$80. The “cost of saved energy” is simply this annual cost divided by the annual savings: $\$80/248 \text{ gallons} = \0.32 per gallon of oil equivalent. The cost of saved energy associated with each of the Bowman house investments is shown in the table.

Our conservation investment criterion is that an investment is cost-justified if the cost of saved energy for that investment is less than the replacement cost for energy. Starting with the most cost-effective investment, one would pursue further investments until the cost of saved energy for the last investment (the marginal cost of saved energy) is equal to the replacement cost for energy. What is the replacement cost for energy delivered to residential customers? In the White House Fact Sheet on the Presi-

The Economics of Saved Energy in the Bowman House



Conservation measure	Investment ^a (dollars)	Savings ^{a,b} (per cent)	Cost of saved energy ^c (1978 \$/gal.)
1 Storm windows	780	25	0.32
2 Wall insulation	840	20	0.44
3 Floor insulation	480	7.5	0.67
4 Added attic insulation ^d	550	6	0.95
1 + 2	1620	45	0.37
1 + 2 + 3	2100	52.5	0.42
1 + 2 + 3 + 4	2650	58.5	0.47

a The Bowman house, (with a floor area of 2054 sq. ft.) initially had insulation only in the attic (3½ inches) and double glazing only on a living room picture window; all other windows had single glazing. Before the storm windows and insulation were added, efforts were made to reduce air infiltration by caulking, weather-stripping, etc. This effort (which cost \$190) resulted in no measurable savings. This is probably because the house was quite airtight to begin with, having an air exchange rate of 0.2 to 0.6 air exchanges per hour. A more typical house has 1 to 2 air exchanges per hour. (See D.M. Burch and C.M. Hunt.)

b The savings are relative to a pre-retrofit annual consumption level of 990 gallons of oil. The furnace efficiency is 55%.

c The proper evaluation of capital and operating costs requires their comparison on the same footing. The method of evaluation used here facilitates that comparison by assuming equal loan payments in constant dollars for each year over the

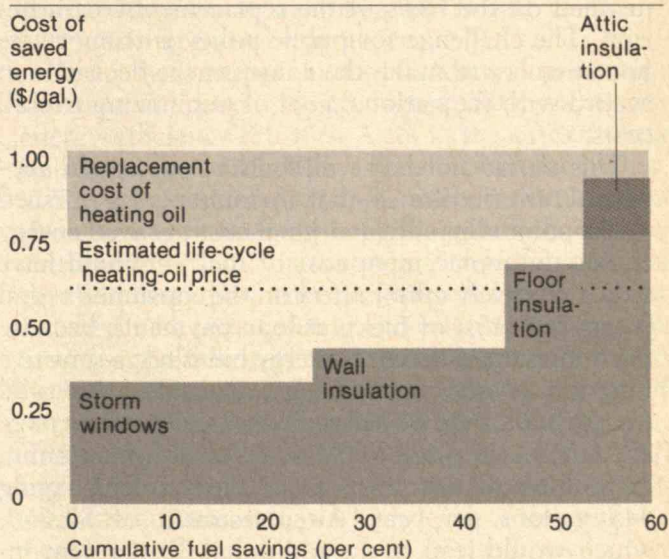
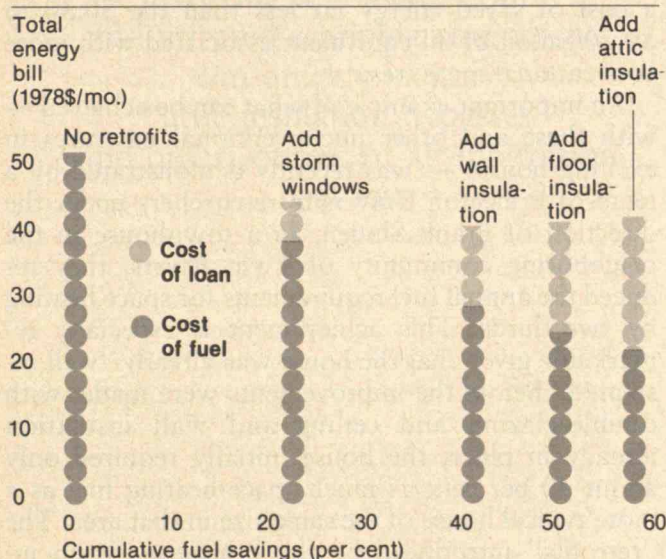
life of the loan. The levelized annual payment P (in dollars/year) on a loan L with an interest rate i and a term of N years is:

$$P = \frac{iL}{1 - (1+i)^{-N}}$$

For $i = 0.06$ (the "real" interest rate for a home-improvement loan with a nominal 12% interest rate and a 6% annual inflation rate) and $N = 15$ years, $P = 0.103L$. For an annual fuel savings S (in gallons/year) associated with an investment L , the cost of saved energy is:

$$C = 0.103L/S \text{ dollars per gallon.}$$

d Six inches of loose fill cellulose insulation were blown on top of the existing 3½-inch glass fiber blanket in the ceiling. The costs of saved energy associated with installing attic insulation where none exists initially would be much less than the cost shown here.



The monthly bill shown above is based on an estimated life-cycle heating-oil price of \$0.60 per gallon (1978 dollars). All other data from table above.

dent's Import Reduction Program (July 16, 1979), it is estimated that synthetic liquids from coal would cost \$38/barrel. Residential heating oil derived from such liquids would probably cost about \$1.00/gallon. If the direct replacement cost of residential heating oil were instead based on the world oil price at the end of 1979, it would be somewhat less — about \$0.75/gallon.

The cost of saved energy associated with the Bowman house investments should be compared with estimates of the replacement cost (*see figure on page 27, right*). The first three investments (which permit a 52 per cent fuel savings) are clearly justified by our criterion. The last investment (for ceiling insulation) may or may not be cost-justified depending on whether the replacement cost is higher or lower than \$0.95/gallon.

But prices have been much lower than these replacement costs. In 1978, the price of heating oil was only \$0.50/gallon, while the price of residential natural gas averaged only \$0.35/gallon of oil equivalent. The homeowner in 1978 might have expected these prices to increase in the future at the same rate as in the period from 1974-78: 2 per cent and 8 per cent (faster than general inflation) per year for oil and gas, respectively. Thus he might have expected that the price of oil or gas, over the life of these investments, would average only about \$0.60/gallon of oil equivalent. On the basis of this estimated average future price, he would have been willing to invest only in the first two investments shown in the table and thereby capture less than the full savings justified on the basis of the replacement-cost criterion. The challenge for public policy is to motivate homeowners to make their investment decisions in accord with the national goal of minimizing overall costs.

This would not be as difficult as one might suppose. Our criterion — that investments be pursued to the point where the marginal cost of saved energy equals the replacement cost of fuel — would have only a relatively minor effect on the consumer's total energy bill (cost of fuel plus loan payment), because the minimum in the total energy bill is not a sensitive function of the fuel savings. Consider the total energy bill for the Bowman house (*see figure on page 27, left*). At a price of \$0.60/gallon, the minimum fuel bill would arise for a \$1,620 investment, saving 445 gallons per year. An investment of \$2,650, which would lead to an additional 30 per cent increase in fuel savings, would mean an increase in the total monthly energy bill of only 5 per cent, or \$2.

Unconventional Opportunities

Most people think of measures similar to those adopted for the Bowman house when concerned with residential energy conservation. While these measures can lead to substantial savings of both energy and money, they are not the only possibilities.

One source of unconventional measures for saving fuel is the reduction of obscure, unwanted air flows — losses that bypass insulation. The magnitude of such heat loss is illustrated by the escape of warm air, through various pathways, into the attics of houses: an open shaft around a flue that extends from the basement to the attic, plumbing vent pipes, stairwells, spaces within walls, and unsealed interior walls around dropped ceilings. Gautam Dutt and Jan Beyea of Princeton University's housing energy research group have estimated that heat losses through "attic insulation bypasses" in one- and two-story single-family wood-frame houses account for about 20 per cent of total U.S. energy use for residential space heating.

A new diagnostic technique — involving a "blower door" (a powerful fan mounted in an outside door frame and used to pressurize or depressurize a house), an infrared scanning device, and related equipment — has been developed by the housing energy research group to quickly identify such bypasses and other sources of air-infiltration heat loss. Once identified, such heat losses are usually worth remedying: plugging these holes involves a cost of saved energy far less than the \$0.30 to \$0.70/gallon of oil equivalent associated with more conventional measures.

An important example of what can be achieved — with these and other unconventional measures in existing houses — was recently demonstrated by a team of Princeton University researchers under the direction of Frank Sinden. In a townhouse in the neighboring community of Twin Rivers, they reduced the annual fuel requirements for space heating by two-thirds. This achievement is especially remarkable given that the house was already "well insulated" before the improvements were made; with double-glazing and ceiling and wall insulation already in place, the house initially required only about 40 per cent as much space-heating fuel as a more typical house of the same size in that area. The "retrofits" introduced by the Princeton group included such measures as extensive caulking to reduce unwanted air leaks, insulation around the



A new diagnostic technique, involving a "blower door" and infrared scanning equipment, can quickly identify "attic insulation bypasses" and other sources of air-infiltration heat loss.

perimeter of the basement, and the installation of indoor shutters to be placed over large windows at night.

If retrofitted houses become very airtight, as this Twin Rivers townhouse did, then indoor air quality can become an important concern. One possible corrective action is to install a forced ventilation system with a heat exchanger so that heat is recovered from stale exhaust air and transferred to fresh incoming air. Such a system, capable of recovering 70 per cent of the heat from exhaust air, is now on the market and costs \$200. It can be installed in a window much like a room air conditioner.

Implementation Hassles

Despite the large potential for fuel savings and the favorable economics of improvements in residential energy efficiency, only a small fraction of such savings will be realized over the next decade unless major institutional obstacles are overcome.

Homeowners will not base their investment decisions on replacement costs when their perceptions of future prices are overly optimistic. And even if convinced that future prices justify conservation investments, many consumers will be unwilling to proceed: the resultant dollar savings will be judged insufficient to compensate for the considerable "hassle" of a home retrofit project. Such a project involves three steps:

- ☐ A housing conservation audit must be arranged.
- ☐ An installer in whom the consumer has confidence must be identified and hired.
- ☐ Financing must be arranged.

To further complicate matters, there is presently a shortage of people to do high-quality audits and energy-efficiency retrofits. Also, in the case of rental buildings, the fuel-bill payer is often not the owner.

We are persuaded that these obstacles could be overcome with acceptable public policy changes because of the compelling economics of improved residential energy performance. We will sketch the outline of a new policy that could lead, by 1990, to the saving of half the fuel the nation now uses for space heating in existing residences, for an average investment level of about \$1500 per dwelling unit. This policy involves retrofit pilot projects, the training of "house doctors," and innovative financing measures to encourage a high level of implementation.

Thousands of Demonstrations

Demonstration projects are essential because the nation's responsible housing professionals do not yet adequately understand household energy performance. If \$1,500 per house or apartment is to be invested, on the average, in conservation, it is essential to know what steps are most effective and to be able to estimate the fuel savings that would probably occur. Handbooks and computer programs are now widely available to provide just that information. However, they are often unable to provide the best advice for making conservation investments on an individual case basis. "Models" are based on the assumption that a building is like an idealized box, but a real building — with its irregularities and complex heat flows — cannot always be treated that way. Analysis of heating systems is also often based on inadequate information.

The magnitude of the problem is illustrated by the "attic insulation bypasses" described above. A recent investigation by Dutt, Beyea, and Sinden showed that, for 40 houses tested in various parts of the Northeast, actual heat losses to the attic were three to seven times greater than the theoretical heat losses (calculated for the heat flow through the ceiling insulation).

Because of such bypass heat losses, handbooks or computer programs will usually fail to give people advice that will minimize the cost of improving the energy performance of their houses. A homeowner who follows advice to add more ceiling insulation may get only one-third to two-thirds of the fuel savings claimed for the insulation job. While this may be cost-effective, the homeowner could often save much more for the same level of investment if the bypasses were blocked first. And the new insulation job may make it much more difficult in the future to find and plug up the bypass heat flows.

To reduce such heat losses, we must obviously first identify them. But this problem has not been widely studied in the United States. Most types of housing still have not been tested, and even the basic diagnostic techniques for quickly identifying such heat losses have only recently been developed.

What is needed are demonstration projects involving the intensive investigation of *thousands of individual houses and apartments* — representing all the major types of housing in every region of the country. These investigations should be conducted by competent housing researchers, and regional programs should perhaps be coordinated by agencies



A "house doctor"
thoroughly familiar with
most housing types in a given region,
can quickly identify
the important
thermal attributes of a
small building.

possessing the necessary technical skills (such as the National Bureau of Standards and Lawrence Berkeley Laboratory). Inspection, measurement, analysis, retrofit, and performance evaluation are needed (including measurements of indoor air quality before and after retrofits) in each case. If the post retrofit evaluation shows that the performance improvement is much less than expected, the sequence should be repeated. The goal should be to identify a set of measures that, if carried out routinely, would minimize overall energy costs for each type of housing (typically reducing energy use for space heating by 50 to 75 per cent).

While this process may sound complicated, the total effort would cost only \$5,000 per housing unit. A solid experimental basis for retrofitting most housing types in the nation to achieve the fuel savings goals set forth here could probably be achieved in two to four years with a total research budget amounting to about 50 million dollars. Moreover, it would not be necessary to wait until the research was completed on all types of housing before proceeding with the next phase of the overall retrofit program. As research results are obtained on a particular type of housing, they could immediately be utilized in the retrofit effort for that type. The payoff from this effort could thus begin within a year after initiation of the program. This is in sharp contrast to research and development projects for conventional energy supply technologies, where the first payoffs do not occur until many years later.

A Doctor for the House

In general, building owners do not know how best to spend money on conservation investments. Builders, moreover, typically do not have the technical skills to design an optimal housing retrofit. They both need expert advice. What is needed, therefore, is a new profession of "house doctors." The house doctor, originally proposed by Robert Socolow of Princeton University, is a person who understands housing from a thermal standpoint — one who can quickly identify (with the help of diagnostic equipment) the important thermal attributes of a small building and who is thoroughly familiar with effective retrofits on most types of housing in the region. Every community needs house doctors who can function as housing inspectors or auditors, as installers of conservation materials, and as vocational instructors who train other such auditors and installers. We focus here on the housing auditor. The

house doctor as auditor would make "house calls" not only to diagnose the needs of houses from a thermal standpoint, but to suggest remedies for other energy ills of the house as well — she could recommend flow-restrictor shower heads, water heater installation, or the installation of heat recovery devices, for example.

The institutional framework for a nationwide program of housing audits already exists. The 1978 National Energy Conservation Policy Act requires that public utilities provide to building owners, on request, a building audit that would result in a set of recommendations for conservation investments.

The primary strength of this law is that it is universal: in principle, utilities can serve nearly all buildings. But the present law's fundamental weakness is that it does not have a strong-enough technological basis. Auditors trained according to the provisions of the law would understand how *ideal* houses work, but they might not learn about real houses.

This shortcoming is not an intrinsic difficulty, but is amenable to solution. A training program is needed that is firmly rooted in experience. One strategy would be to establish regional training (and perhaps certification) programs in conjunction with the regional housing retrofit projects. Because this combined research and training program would involve extensive measurements for typical types of housing, detailed measurements could be avoided in subsequent routine audits and audit costs could thereby be controlled. The house doctor's training should thus enable a competent diagnosis on the basis of rapid inspection.

The Department of Energy has estimated that an audit for its Residential Conservation Service (RCS) program would require two and a half person/hours and cost about \$60. A high-quality audit such as that proposed here would cost more — but the increased savings would more than justify the cost. The Princeton housing energy research group has proposed a combined audit/partial retrofit strategy that would make the more costly audit very attractive. They propose that, in addition to making recommendations for major improvements in energy efficiency, the auditor carry out simple on-the-spot partial retrofits (involving, for example, furnace efficiency improvements and the reduction of "bypass" heat losses). Many such heat losses can be reduced or eliminated rather quickly, using a few simple materials such as small sheets of plastic, tape, or small quantities of insulation. (This remarkable

possibility arises because many bypass heat losses involve unwanted air flows through relatively small areas, the reduction of which is intelligence-intensive but not nearly so labor- and materials-intensive as the more conventional conservation measures.) Dutt has estimated that while these audit/partial retrofits would cost perhaps two to three times as much as the RCS audit and require half a day per house (for a team consisting of a "house doctor" and an assistant), the partial retrofit alone could typically save 15 to 20 per cent on space-heating fuel.

The auditor's responsibilities for a given house must not end with a single diagnosis. After the major improvements have been carried out, the auditor should return to inspect the quality of the work — to see if corrective actions or additional retrofits are necessary. And even this post-retrofit inspection should not be the end of the evaluation process. Energy performance should be continually monitored by statistical analysis of utility bills, before and after retrofits. While such a before-and-after comparison can be misleading for individual houses (because energy use in a given house is so sensitive to the occupants' behavior), monitoring a large-enough sample can provide a convincing evaluation of regional energy performance. This kind of monitoring could be carried out routinely, at low cost, and would provide a continuing evaluation of the housing retrofits handled by particular auditors and contractors.

Utility Involvement

An all-out effort to retrofit houses to improve their energy performance over a ten-year period could require a capital investment on the order of \$10 billion per year. This level of investment is economically justified because the cost of saving energy, even to the high degree proposed here, would be less than the cost of the investments in energy supply that would thereby be unnecessary. This is a staggering expenditure, but it is only about 15 per cent of the value of housing construction contracts, or 15 per cent of the investment in energy supply in the U.S.

The financial problem for such conservation investments is not necessarily in finding the capital — it is primarily one of motivating consumers to invest in conservation and of channeling available capital to these conservation projects. The financing opportunities differ, depending on whether the space-heating fuel is electricity, gas, or oil.

Electric and gas utilities provide a particularly

promising institutional framework for financing building investments that save electricity and gas. Involving these utilities could lead to a high level of conservation investment, in just a few years, because of their unique characteristics:

- These utilities are accustomed to raising large amounts of capital. (In 1977, they accounted for about one-quarter of all new plant and equipment expenditures in the U.S. economy.)

- Utilities offer an existing administrative structure for channeling the needed capital to nearly all households.

- Utility financing provides a natural institutional framework for valuing saved energy on a replacement-cost basis. (Utilities, unlike the customers they serve, are faced with an investment choice between conservation and supply expansion.)

- Utility financing provides a mechanism that could facilitate the evaluation of conservation investments on a life-cycle-cost basis. (The customer could be charged on her utility bill the loan payment for the conservation investment. If the loan had a term comparable to the 10-to-20-year financial life cycle of most conservation investments, the customer, upon receiving advice on a range of investment opportunities, could approximately minimize life cycle costs by investing to the level that minimized her total monthly utility bill.)

- Utilities are already required by law to offer audits. If they also became involved with financing, they would be in a good position to offer consumers a comprehensive conservation service — providing the audit and post-retrofit inspection, coordinating the contractor work, and arranging the financing. Such a "one-stop retrofit service" would minimize the hassle that now inhibits many householders from making improvements in energy efficiency.

Regulatory changes are needed to help assure that utilities would be motivated to evaluate conservation projects on the same basis as supply projects, however. Because most utilities are allowed by state regulatory commissions to make a profit only on the energy supply capital they own, conservation investments would not, in today's regulatory climate, be treated on an equal footing with supply investments.

The Oregon Plan for Electric Heating

One arrangement designed to motivate the utilities to make conservation investments has been instituted in the state of Oregon, where electric utilities



Many heat losses involve unwanted air flows through relatively small areas, the reduction of which is more intelligence-intensive than labor- or materials-intensive.

are allowed to finance conservation investments (for residential electric heating customers) and introduce them into the rate base (this is called "rate-basing"). An electric-heating customer may request an audit of his dwelling. Subsequently, the utility will offer to finance and contract for that part of the work (recommended by the auditor) that the homeowner actually wants done. Since the cost of the conservation investment goes into the rate base, the homeowner does not pay for the retrofit outright; rather, the customer repays the utility, without interest, only if and when the house is sold.

One of the most attractive features of the Oregon plan is that it should lead to a high level of participation because it provides a one-stop retrofit service with very attractive financing. While conventional conservation investments lead to dollar as well as fuel savings, the resulting reduction of the consumer's total energy bill based on life-cycle costs (the costs of fuel plus the loan payment) is often not large enough to be a strong incentive to invest (*see figure on p. 27*). In the Oregon plan, the energy bill for participating consumers should drop markedly because the interest payments on the investments are spread among *all* customers.

A startling fact is that this arrangement would not penalize nonparticipating customers. Utility expenditures for conservation would be approximately balanced by the savings to the utility in deferring new supply investments. In other words, even though the utility would provide "free" retrofits to some customers, the price of electricity would rise only about as fast as it would have without the conservation program. This remarkable result arises because the cost of saving energy is expected to be much less than the cost of expanding the energy supply. In the case of Oregon's Pacific Power and Light utility, for example, "the test will be whether, in each instance, the cost of 'producing' the energy to be saved through installation of insulation or weatherization is sufficiently less than the cost of producing equivalent energy through new production to provide long-term benefits to all rate payers. This test will be uniformly and objectively applied, and cost-effective installation will be available to all qualified customers who meet the test."

Another attractive feature of this plan is that it provides the basis for protecting low-income groups against the impacts of rising energy prices. The poor spend a much larger fraction of their income directly on energy than do higher-income groups, and rising energy prices present the poor with an especially

heavy burden. This problem had led to proposals for "lifeline rates" and other measures to keep energy prices low for low consumption levels. Unfortunately, however, such measures often end up subsidizing the energy consumption of middle- and upper-income consumers as well, thereby reducing their incentives to conserve. In contrast, utility financing of conservation investments would protect participating low-income households without reducing anyone's conservation incentive.

An additional virtue of this plan is that it provides a direct mechanism for encouraging conservation in renter-occupied buildings. A formidable obstacle to conservation investments in such circumstances is that the building owner has no significant incentive to make conservation investments if she does not pay the energy bills. Putting conservation investments for rental properties into the rate base, however, is an attractive arrangement for renter and utility because it does not place a burden on the owner (except by increasing the sale price of the building).

Gas and Oil, Too

Putting gas-heating conservation investments into the gas utility rate base could lead to especially large space-heating fuel savings because natural gas accounts for nearly half of space-heating fuel use, and costly new gas sources will eventually cost residential customers about twice what they now pay for gas. Gas utilities should be attracted to this approach because it would provide substantial opportunities for rate-base expansion: not only would the conservation investments themselves add to the rate base, but the saved gas could be used for other customers. Saving half the gas we now use for space heating in residential and commercial buildings would free up gas supplies equivalent to 40 per cent of the total amount of oil used today by industry. Thus, gas saved in buildings could be used to substantially reduce industry's dependence on oil. (A particular gas utility today may be reluctant to seek such savings, however, for fear that the saved gas might be reallocated to another utility. It is clearly in the national interest to eliminate such disincentives from the nation's gas-allocation policy.)

Of course, the Oregon plan (or its equivalent for gas utilities) is not perfect. There are conditions under which nonparticipating customers would be penalized by rate-basing. Therefore, it has been suggested that the extent of rate-basing be restricted

by a "no-losers test," in which rate increases resulting from conservation investments would be no greater than if there were an equivalent amount of supply expansion. In practice, this would mean that the cost of saved energy should be less than the difference between the cost of energy from new sources and the cost of energy from existing sources. This is clearly a more restrictive criterion than ours — that one should invest in saved energy until the cost of the last increment of saved energy equals the replacement cost. The "no-losers test" justifies a high level of conservation investment in Oregon because there the cost of electricity from new sources is much higher than the present (low) electricity prices that reflect the high dependence on hydroelectricity in the Pacific Northwest. But in many parts of the country — particularly in areas where utilities burn a great deal of oil — the difference between the cost of electricity from "new" and "old" sources is not as large as in Oregon, so that a much lower level of conservation investment would be justified by the "no-losers test."

Even if a "no-losers test" is adopted, utility rate-basing of at least a *portion* of a particular housing conservation investment could be an important element in an overall incentive package. The utility incentive should be complemented by government incentives (federal and/or state), if needed, to induce the consumer to invest to the level justified by valuing saved energy at the total replacement cost of energy. The utility and government incentives might be combined to make it attractive for the consumer to invest to the level that would minimize the cost to the nation. In the case of the Bowman house, for example, the consumer without a subsidy would be motivated to invest only \$1,620 (*see table*). He might be offered a combined utility-government interest subsidy of 5 per cent, contingent upon increasing his investment level to \$2,650. He should be motivated to accept this offer because with the subsidy, his total monthly energy bill (including loan repayment) would be 10 per cent less than it would be if he had no subsidy on an investment of \$1,620.

Thus, even partial rate-basing of conservation investments would be important in motivating electricity and gas consumers to conserve. Moreover, this would help motivate utilities to pursue effective conservation programs. Although utility financing of conservation investments is prohibited by the 1978 National Energy Conservation Policy Act (the Oregon program, initiated before the passage of the act, may continue because of a "grandfather



The Conservation Supply Curve

by Alan Meier

Statements like "we've conserved just about all the energy we can" or "the full potential of energy conservation has virtually been realized" are frequently heard, even from people who should know better.

But as conservation becomes well understood — forcing people to analyze energy efficiency in terms of total benefits accruing to the consumer, the supplier, and the nation as a whole — it becomes reasonable to think in terms of a "shopping list": a ranking of conservation measures, and their corresponding energy savings, which become cost-effective at higher energy prices. Such a list, in effect, is a supply curve of conserved energy, perfectly analogous to a supply curve for new energy sources.

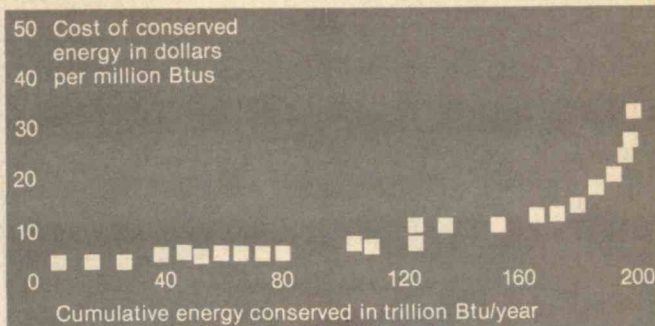
At a given energy price, in other words, certain conservation measures — energy *not* needed after all — become cost-effective. Similarly, on the supply end, higher energy prices might lead to the development of new sources to meet the increased energy demands.

Only in the last few years

has "integration" occurred — combining the conserved-energy supply curve and the new-sources supply curve. Thus, as energy prices rise, it may be cheaper (in a national sense) to pursue a certain conservation measure rather than to develop a particular new energy source. At still higher energy prices, that new source might be cheaper than some other conservation approach, and so on.

The combined supply curve is a simple academic exercise; yet it has tremendous implications for energy policy. Essentially, it treats conservation and increased supply as equals. It also shows how conservation will not be used up; rather, as energy prices rise, more exotic and cleverer methods will be found to conserve. Just as new reserves of energy will be discovered, so too will new "reserves" of conservation.

Will we soon exhaust our conservation reserves? Probably not. The second law of thermodynamics dictates the minimum energy needed to perform the task; the difference between what is currently used and the thermodynamic minimum constitutes the conservation reserves. But even this can change if we redefine the task. An example would be to change from the goal of heat-



In this conservation supply curve (developed by Alan Meier and Jan Wright for the California Policy Seminar at the University of California, Berkeley), price vs. annually saved energy — statewide — is shown for 24 conservation measures in gas-heated homes. Each point

corresponds to the average cost of conserved energy for a given conservation measure. If all measures were taken, assuming the price were right, 197 trillion BTUs would be saved annually (out of 317 trillion BTUs currently used for gas heating in California).

ing a house to the more precise one of keeping the occupants warm. Microwave ovens are another example — that is, heating the food rather than the air inside the oven. This reduces the minimum energy, thereby increasing the conservation reserves, with technological innovation obviously playing an essential role in allowing the task to be redefined.

Although energy conservation is slowly gaining recognition and legitimacy, problems remain — particularly in achieving already acknowledged conservation poten-

tials. Solutions clearly require the development of new institutions, but the crucial realization must be that energy conservation is not a stop-gap measure. It is a response to energy shortages — with new supplies being the alternative — and the determinant of choice is the price.

Alan Meier is a graduate student in the Energy and Resources Group at the University of California at Berkeley. His interest in residential energy conservation has been manifested in his teaching, community work, and doctoral research.

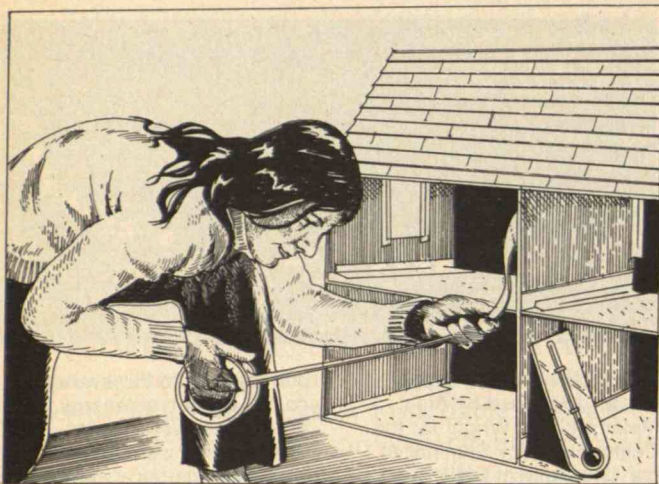
clause”), this prohibition may be removed in energy legislation currently before Congress.

The utility financing model cannot be directly applied to oil-heating customers. Yet, since our energy crisis is mainly an oil crisis, and since residential oil heat accounts for about 1.25 million barrels of oil per day, a financing arrangement that will lead to a high participation rate and a high fuel-savings rate is badly needed for oil-heating conservation investments.

One way to create incentives for oil-heating customers, similar to those potentially available through utilities for electric- and gas-heating cus-

tomers, would be to set up special financing corporations to make investment capital available for heating-oil conservation projects. Such corporations could perhaps organize housing audits and arrange for installation as well, thus providing the same “one-stop retrofit service” we have proposed for utilities. These corporations could obtain capital either from institutional investors (such as insurance companies) or from the sale of bonds.

A policy might be adopted that would enable such corporations to offer customers essentially the same financing terms provided in the Oregon electric utility plan. The customer would pay nothing directly



Many heat losses
can be reduced or eliminated
rather quickly, using
a few simple materials
such as small sheets
of plastic, tape, or small
quantities of
insulation.

for conservation investments, but would be required to pay for them at the time the house is sold. Interest on these investments would be paid by the government. One way to obtain the needed revenue would be to levy a tax on heating oil. We estimate that the interest could be paid on loans covering all residential investments with a tax that would increase (in current dollars) from about 1.5 cents/gallon in the first year to about 20 cents/gallon at the end of the ten-year program, and the tax would then be cut in half every five years thereafter. Alternatively, the interest could be paid for with revenues from the windfall-profits tax associated with the decontrol of oil prices. We estimate that the total interest payments on residential oil-heating loans would total \$26 billion.

A Preferable Source

The housing retrofit program we have outlined is very ambitious. It could not be realized if even one of the three program components — the retrofit pilot projects, the house-doctor training programs, or the financing measures — were compromised. But the effort, in just a few years, could significantly reduce our dependence on insecure sources of foreign oil, help stabilize energy prices, and lead to the creation of over 200,000 jobs for conservation auditors and installers and many more jobs for the manufacturing and marketing of the needed materials and hardware. The effort would also be much less costly and much more effective in helping to rapidly close the oil supply/demand gap than a synthetic fuels strategy, and far more preferable than the imposition of draconian energy-rationing measures.

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Robert H. Williams is senior research physicist at Princeton University's Center for Energy and Environmental Studies. Marc H. Ross is professor of physics at the University of Michigan, Ann Arbor, and chairman of the Industrial Steering Group of the Energy Productivity Center of the Mellon Institute in Arlington, Va. Ross and Williams are coauthors of *Our Energy: Regaining Control* (to be published by McGraw-Hill in 1980), which sets forth an energy conservation strategy for the U.S.

New survey measures attitudes towards energy conservation and government incentives.

- ☐ "Does energy conservation have a constituency? Enough to warrant new government initiatives, new incentives?"
- ☐ "How do people rank conservation against other energy sources — solar, coal, oil, synthetic and nuclear?"
- ☐ "Where do people expect energy savings to come from — cutbacks in living standards or improved efficiency?"
- ☐ "Would cash grants to homeowners generate meaningful conservation? At what level of reimbursement?"
- ☐ "Is there support for government programs to help business pay for improved energy efficiency? Will people endorse business tax relief for such purposes?"

Union Carbide, a major energy user with a big stake in the nation's energy policy, recently commissioned a national study on public attitudes toward energy conservation. Among the findings:

Conservation is one of the few aspects of energy policy that is relatively noncontroversial; nearly everyone believes that America should reduce its energy use in future years. In addition, the public supports a *balanced* approach to our energy future, including degrees of dependence on solar, coal, oil, synthetic fuels and nuclear, as well as conservation.

The study concentrates on the question of putting conservation to work. Who is to conserve? At what sacrifice? And what can government do to translate the public's support for improving energy efficiency into new "conservation energy"?

Our study consists of in-depth interviews with a national probability sample of 1,000 adults conducted by Roger Seasonwein Associates between November 5 and November 25, 1979. In the belief that the findings can be useful to policymakers and businessmen seeking new energy solutions, we are making the study available on request.

How to get a copy:

For a copy of the study, write
"Conservation Study"
Union Carbide Corporation
Box TR38, 270 Park Avenue
New York, N.Y. 10017.





Lead Exposure and Human Health: Recent Data on an Ancient Problem

by Herbert L. Needleman, M.D.

Lead's toxic properties,
known since Biblical times,
still take a heavy toll on human health.
And new data show that
children are
at much greater risk than had
been suspected.

Relatively recent studies of both humans and experimental animals indicate that lead toxicity, or plumbism, occurs at lower doses than previously believed. As a result, more stringent controls on lead have been applied in three major areas: the workplace, the atmosphere, and the household. This removal of lead from the environment incurs the costs of applying controls, which are relatively easy to measure, and produces benefits, which are more difficult to quantify. As a result, the question of health effects at low dose has become the focus of intense controversy in recent years. The manner in which the problem of environmental lead is handled will undoubtedly serve as an important paradigm for regulating other chemical or physical agents that are at once useful and dangerous.

The Morbidity of Lead Poisoning

The symptoms of mild lead poisoning are often vague and nonspecific: headache, malaise, abdominal pain, irritability, and pallor may be the only features that are observed, and they are easily overlooked, especially in children. With increasing dosage, the brain swells and often hemorrhages, a condition known as lead encephalopathy, producing gait disturbances, stupor, coma, and convulsions. Often children with complaints stemming from the milder symptoms of plumbism are not taken to a doctor and of those who are, many are misdiagnosed. Indeed, even hospitals in areas where lead poisoning is endemic may rarely report cases because physicians are not alert to the possibility of the disease.

Many separate organ systems are affected by lead. Examples of such effects include: increased

myocardial irritability, kidney dysfunction, liver dysfunction, decreased peripheral nerve conduction, and drop in the production rate of immune proteins. As is the case with many toxicants, a developing organism's brain is more vulnerable than that of an adult. Indeed, the immature brain is also vulnerable to many other stresses, including nutritional deprivation and radiation.

The damaging role of lead has been demonstrated in numerous laboratory studies:

□ Dr. David Brown of the University of Maryland showed that rodents given lead during their first 11 days of life became poor learners, while those given the same dose from 11 to 21 days were not measurably affected. Only at *four times* the smaller dose was behavioral deficit observed in the older subjects. This different sensitivity may be due to differences with maturity in permeability of the blood brain barrier, a physiological mechanism that regulates the concentration of many compounds in the brain.

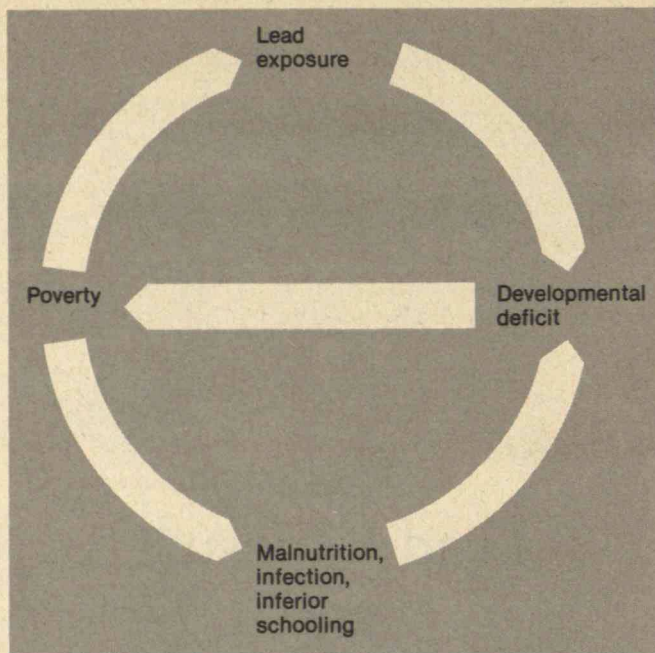
□ Dr. Damon Averill of the Children's Medical Center and I showed that rats given doses of lead insufficient to produce anatomical changes under the light microscope have fewer and less mature synapses.

□ Dr. R. J. Bull and his colleagues at the U.S. Environmental Protection Agency laboratory in Cincinnati demonstrated delayed brain development (late appearance of brain cytochromes), respiratory pigments in blood, and delayed synaptic development in rats prenatally exposed to lead.

History of the Problem

Lead has been mined, smelted, and compounded with benefit and hazard since antiquity. Knowledge of its toxic properties is ancient — but has been frequently ignored throughout history.

Egyptian documents written before the Hebrew Exodus show that lead was used in cosmetics, the casting of human and animal figurines, dishware, and fishing net weights. The Old Testament contains instructions for separating lead from silver ore. In the second century B.C., Nicander, a Greek poet and physician, clearly described the symptoms of lead colic. Dioscorides, in the first century A.D., wrote that ingesting lead "... causes oppression of the stomach, belly, and intestines with intense gripping pain. ... It suppresses the urine, while the body swells and acquires a leaden hue." Pliny wrote of the hazards of breathing lead fumes: "While it is being melted, the breathing passages should be protected



Poverty leads to lead exposure and developmental deficits, confounding the study of lead's effects on brain function.

Investigators must separate the effects of lead exposure from those of poverty.

MIT



Washington wonderland of policy, politics and press **A2**

The I.A.P. experience, by John Molitoris, '80 **A5**

Students conduct research in N.A.S.A.'s Marshall Space Center neutral buoyancy simulator **A6**

I.A.P.: from artists in residence to professional internships for architecture students **A10**

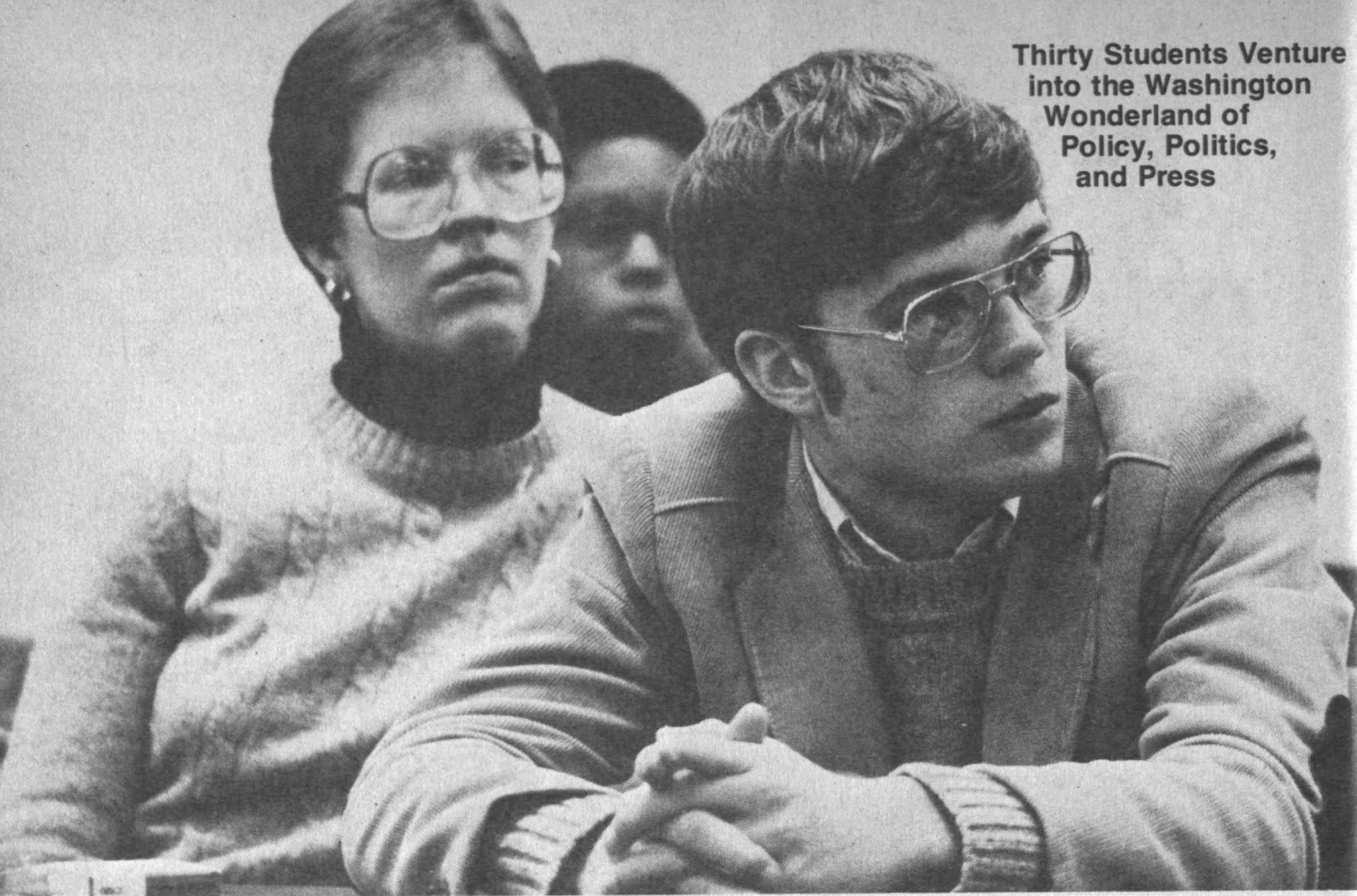
People **A15**

Courses **A17**

Puzzle Corner **A21**

This page: Glass blowing, a popular I.A.P. activity.
(Photo: Mark Sloan, '81)

Thirty Students Venture into the Washington Wonderland of Policy, Politics, and Press



Come with us — 30 M.I.T. students released from the pressure of classes by the Independent Activities Period and interested in public policy and how government works. Look behind Washington's federal facades to hear participants in the governmental process explain, jest, criticize, and wax philosophical.

For three clear, cold, invigorating days in January I listened as those students met with alumni and others ensconced in the Washington political scene. We scurried through the cold, crowded streets from one executive office to another and then up to Capitol Hill on a tight schedule, all the time trying to fathom the idiosyncracies of a government that seems complex enough to meet every possible need and yet too weak, burdened by all the artifacts of democracy, to do decisively what needs to be done.



Early Wednesday morning on Capitol Hill, the Russell Senate Office Building is imposing, security tight. We assemble to hear a panel on energy policy.

David L. Bodde, S.M. '73 (above), deputy assistant secretary for coal, nuclear, and electric systems in the Department of Energy's Office of Policy Evaluation, describes his role as a policy analyst: We view the energy problem as an analytic problem. Yet the government finds it has to act *before* it has an analytic base for action. We are too often caught unawares by events. In this sense, energy problems are a little like cancer: hard to diagnose but relatively easy to manage in the early stages, easier to see and far harder to cure later.



Mitchell G. Tyson, '76 (above), legislative assistant to Representative Paul Tsongas, one of whose jobs is to keep track of the energy area:

I write speeches, draft bills, monitor positions. When it comes to policy I essentially perform guerilla warfare. If I detect that a decision-making process is political, then I roll up my sleeves and play politics. If I see it's based on the substance of issues, I'll deal with those issues.

The legislative process is chaotic, but its results are surprisingly rational. Good ideas go through the process; bad ideas get held up; mediocre ideas get better. It brings in lots of factions; in the democratic process everyone has to have his say.

We hurry out of the Russell Building to catch the subway and then rush through Jackson Park to the baroque Old Executive Building beside the White House.

Gene Eidenberg, secretary to the Cabinet, who covered a host of topics:

It's been the most exhilarating three years of my life. My office is the eye of a hurricane. There is an unbelievable flow of information, an unstoppable flow of issues that require a decision. A president doesn't get a problem that's easy. The issues that come to the White House are the tough ones — the questions that no one dares decide, or that are so difficult no one can resolve them. And in tackling them the president is constrained by forces over which he has little or no control. John F. Kennedy said he was impressed, before he was elected, by the power of the presidency. But from the Oval Office he was impressed by its limits.

By now we are starving, but there is barely time to return to Capitol Hill to House Annex No. 1. The clouds have broken and the sun glorifies Washington's magnificent vistas. Inside, in front of a room filled with tables and pitchers of ice water, is a panel ready to discuss environmental policy.



Sheldon Samuels (above), director of health, safety and environment in the Industrial Union Department of the AFL-CIO, begins with a history lesson:

Henry VIII didn't like the smell of peat smoke. The law said that blacksmiths who used peat as fuel were subject to prosecution. One who didn't obey was decapitated as a lesson to everyone else. It's been a little the same way ever since. There is a caste system which we are only now beginning to eliminate: the workers do the dangerous jobs, are most exposed to workplace hazards, and serve at the pleasure of their bosses. Even in Sir Thomas More's *Utopia* there were slaves to do the work, and the slaves didn't share in *Utopia*.



Peter Preuss (below), deputy associate executive director for health sciences, Consumer Product Safety Commission:

The numbers always come out on the side of *not* regulating. Consider the ubiquitous substance known as formaldehyde. We are all exposed; 6.5 billion pounds a year are produced. We're not entirely sure of its effects, but we have very clear numbers on the cost of shifting away from it, substituting something else — a tremendous economic dislocation. So there's lots of pressure from those affected.



Anthony Roisman (below), director of the Hazardous Waste Enforcement Program, Department of Justice:

I thought I was going to tell you about hazardous waste. Now I think I'm going to tell you about life. There is a conflict between making money and having a decent environment. It's very hard for the victim to come forward; none of us thinks he'll be the one. So we are swayed by the lecture on the cost to stop making some suspected carcinogen instead of by the numerically small risk to any one of us. If the victims were the board of directors of the chemical company, then production would stop immediately.

Watch television commercials. Oranges may be green on the tree, but they're orange in the pictures. Cucumbers are shiny, but



have you ever seen a shiny cucumber on the vine? Additives are built into our social fabric. It's not enough to look to the government to make some rules; it's a question of changing life styles.

Continued on page A4

Opposite page, top: left to right, Sue Trautman, secretary for the Public Policy Program, Claudia Perry, '80, and David Lingelbach, '83; opposite page, bottom left: Kate Pressman, staff economist for the Council of Economic Advisors; this page, top right: Laurence Zwimpfer (right), graduate student, Dan Saltzman, '79; middle right: Clifford Mitchell, graduate student. (Photos: Marjorie Lyon)



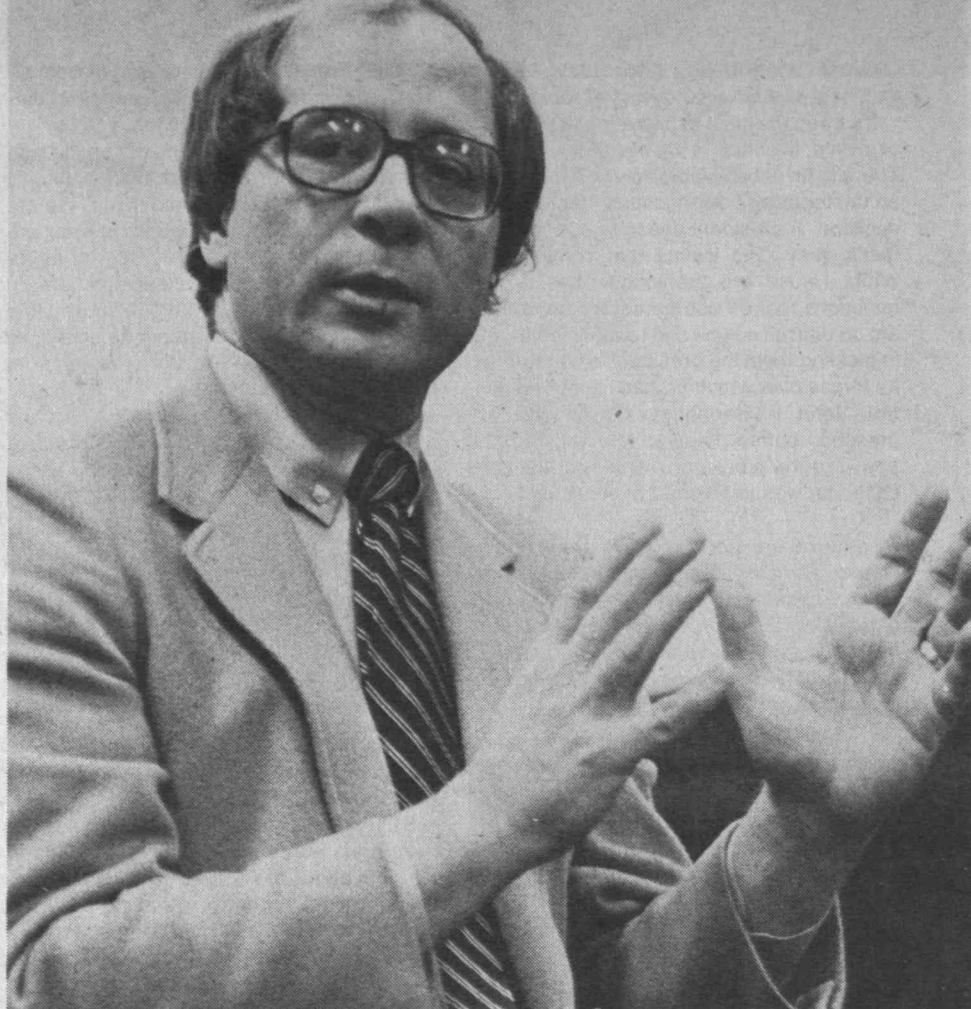
Thursday morning, around a huge table in the New Executive Office Building, we thought we would hear about science policy and advocacy but instead hear a lesson in how Washington information works and how to read the newspapers.

Daniel Greenberg, editor of *Science and Government Report*:

On any issue of public importance in Washington the cast of characters gets to be very large. And any time something is known by three people, it's no longer a secret. Investigative journalism is really *leaked* journalism: there's an issue percolating through the White House and someone turns to the press to gain support or to test public reaction. So there is a deluge of information. And there are intense social relationships between press people and those they cover. Sources call me more than I call them. It's part of the process.

Nothing is politically real in Washington until it's appeared in the *New York Times*, the *Washington Post*, or the *Wall Street Journal*. That's why those papers are so courted. Other papers may have important news, but it doesn't rate. You know that President Carter and others are sitting with their coffee in the morning looking at those three papers. It's a political reality in this town.

Question from a student: Does being dependent on a person for information stop you from being critical of that person?



Friday morning, back on Capital Hill for an informative, disquieting session:

Larry Smith (above), administrative assistant to Senator Gary Hart, was gesturing, sincere, intense:

The darkest threat is that a major new source of social and political power will acquire nuclear weapons — highly trained, highly disciplined paramilitary terrorists. What do you do with suicidal maniacs?

Yet Mr. Smith could still speak of the splendid and damning nature of life. We recognize that we will fail in fundamental ways, he said, and we can only hope that we won't incinerate the earth. That is not a gloomy perspective: it's the excitement of being an aware and involved human being.

The trip was organized by graduate student Clifford Mitchell and Genia Long, '81, with help from Patricia Joffe, who administers the Political Science Department's undergraduate public policy program. In those three busy days we heard many speakers not mentioned here. They all brought an edge of humor, a spirit of jousting in the sometimes absurd situations of politics, and an extremely high energy and commitment to jobs that seemed hard, verging on the impossible. — M.L.



Bottom left: Lincoln Bloomfield, global affairs advisor, National Security Council; middle, right: Bob Wallace, '82; bottom, right: Louise Dunlop, director, Environmental Policy Institute (photos: Marjorie Lyon)



by John Molitoris, '80

A lot of things have been said about M.I.T.'s Independent Activities Period, but the word independent has always been stressed. It is indeed a very free time.

I spent the past four January's in Cambridge, so I've seen all sorts of ways to enjoy I.A.P., from the guy who stays around his fraternity and watches TV all day to the senior who trudges across the Harvard Bridge to do his thesis. Some freshmen are busy finishing up calculus, some sophomores and juniors do research for credit. That's what I did my first three years during I.A.P., in addition to learning fortran, taking diving lessons, and reading.

One activity this winter proved to be quite relaxing. It was a Western approach to meditation called the relaxation response. The organizer, Matt Bunn, '83, demonstrated the basics of meditation. Statistically, meditation helps to reduce stress. Through meditation one becomes very aware of their bodies' needs. Basic functions, such as breathing, hunger, and thirst, become very apparent. You essentially rid yourself of the outside world and simply *be*. Meditation has been proven to decrease one's desire for alcohol, cigarettes, and drugs; it's also much healthier. I found meditation a good way to let the tension drift from my body.

The group compared their reactions to meditating ("I found it extremely beneficial to meditate after exercising." "I was unable to meditate after eating and had to wait an hour or two." "I had a hard time keeping my mouth closed and if I became too relaxed I dribbled.")

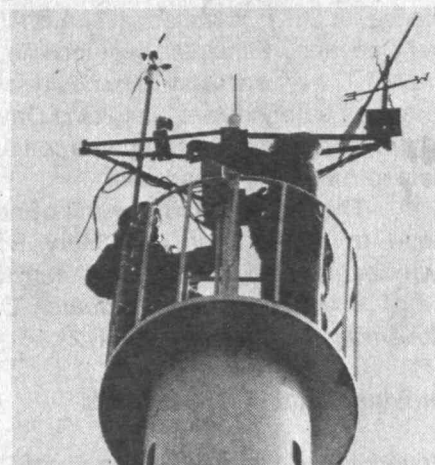
Essentially meditation is as individual as the person who does it.

I also had an interesting experience in January on top of the Green Building. William Gutowski, a graduate student, and Professor Fred Sanders, with the help of students, constructed a meteorological observing station and used it to make daily observations of the surrounding weather conditions. Most of the instruments used were left over from previous projects. Bill had started rounding up equipment as early as

last November. He told me that the only piece of apparatus that had to be bought was a remote temperature recording unit.

When the activity got under way, participants were briefed and then left to work on some part of the station that interested them. Help was provided by the two research technicians in the group, Ed Nelson and "Speed" Geotis. From my own experience, one of the reasons that short projects like this can be accomplished at M.I.T. is because of the extremely competent technical help and the "junkyards" of equipment at M.I.T. which can be used with a little ingenuity.

Bill took me on a tour of the weather station one afternoon. On this day the wind was pretty intense and it was so clear that one could see for miles. Most of the monitoring devices were on top of the tower, which extends about 50 feet above the top of the Green Building.



Climbing up the tower gave me the feeling of being inside a giant flute. The ladder is inside a tube barely three feet in diameter which supports the "crows nest" on top. There are holes in the sides of the tube, and as the wind shifts direction and changes in intensity the tower hits different notes, the higher ones near the top. I suppose if someone designed a system to block off various holes in the tower, M.I.T. could have the world's largest musical instrument! (A future I.A.P. activity?)

Near the top, the wind causes the tower to sway quite a bit. It is exhilarating to be that high up. I wanted to stay there forever and yet leave immediately at the same time. I felt unsafe but I wanted to be there as long as possible because I knew I would not have the opportunity to do it again.

No matter what one does during I.A.P. the mental freedom and huge diversity of events give our academic community a well-earned rest. I know it enables me to face another semester with renewed interest and a fresh frame of mind.

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Students Conduct Research in N.A.S.A.'s Marshall Space Flight Center Neutral Buoyancy Simulator

For experiments in weightlessness, the contrast between the M.I.T. pool and a facility designed specifically for that purpose is enormous. Visibility, for instance, at M.I.T. is limited; at N.A.S.A.'s Marshall Space Flight Center's Neutral Buoyancy Simulator in Huntsville, Ala., the water is astoundingly clear. "At M.I.T. we were lucky if we could scrape together two or three extra people to act as safety divers," explains David Akin, graduate student. At Marshall, where he and six other students conducted research last January, 17 people helped run every experiment.

The opportunity grew out of neutral buoyancy experiments at M.I.T. done by David Akin and Mary Bowden, also a graduate student in aeronautics and astronautics, with the participation of seven U.R.O.P. (M.I.T.'s Undergraduate Research Opportunities Program) students (see November 1979, pages A8-A12).

Builders Clad in Space Suits

Drive into the Marshall Space Flight Center and the rolling fields seem endless; one can even spot cows grazing on its 1,840 acres. Approach your destination in the rainy winter gloom and a military, clean, spare, hospital-like environment dominates. But arrive at Building 4706, housing the Neutral Buoyancy Simulator, and after a moment to contemplate — and feel dwarfed by — its size, look into the water through a porthole. Odds are your reaction will be sheer amazement.

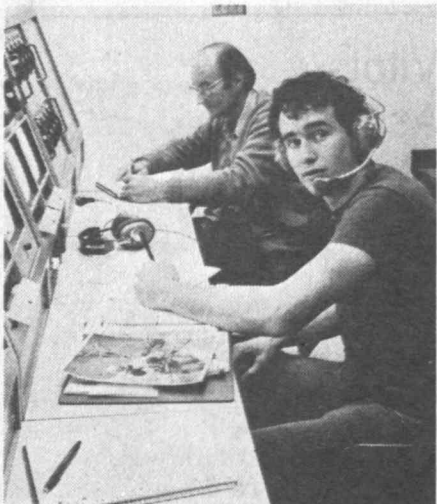
You are looking at 1.32 million gallons of water contained in a steel tank 75 feet in diameter and 40 feet deep, coated with polyester-resin. The water is kept absolutely clear and at a constant 86° F., allowing high visibility and long-term operations. A permeating light blue hue mutes the contrasts.

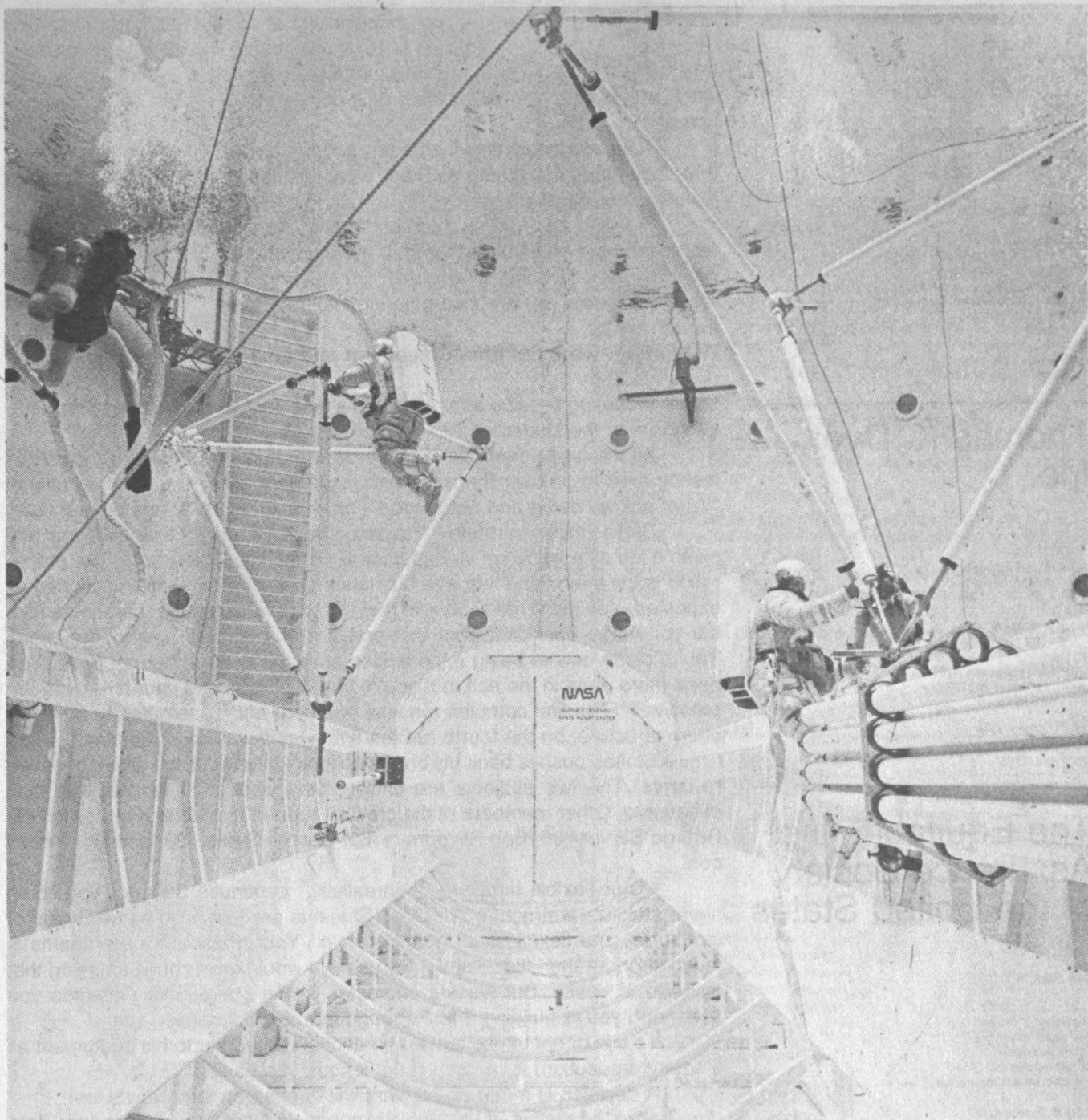
The tank holds a large cast of characters: when I arrive Akin and Michel Floyd, '80, are underwater, clad in space suits, manipulating carefully balanced white beams with red tips. For each spaceman there are two safety divers and one utility diver, wearing scuba gear.

"When working on safety the divers don't kid around," says Jack Stokes, test engineer on the Marshall team. "They're very conscientious; they watch your face — they watch you all the time." Akin agrees. "If I close my eyes for a minute and open them, there's a diver scrutinizing me, hands gesturing to ask if I'm OK," he says.

The utility diver helps the "weightless" worker. If a wrench is dropped, for instance, he will pick it up. (In space, it wouldn't drop). Anywhere up to four photo divers are also in the tank to take movies or stills, (to be used for documentation).

Photos, counterclockwise from top left: David Akin, graduate student, is helped into the neutral buoyancy simulator and descends; Bob Silverman, '80 (right) in the Marshall central control room with Jack Stokes, test engineer; Michel Floyd, '80, is inspected; tank activity; research group: left to right, David Akin, George Sarver, '80, Kim Lewis, '82, Michel Floyd, '80, Gardell Gefke, '83, Mary Bowden, graduate student, and Bob Silverman, '80. (Photos: Marjorie Lyon, Michel Floyd, courtesy Space Systems Lab, and Marshall Space Flight Center).



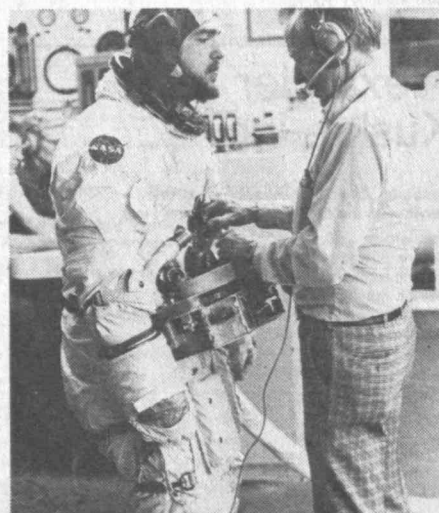


Assembly time is good

Mary watches on the console in the central control room as the space-suited pair in the tank laboriously build an open-framework structure to test their productivity. It is obvious that movement in the suits is difficult. Mary talks to the divers through a microphone and listens to their reply in head phones. The conversation is also broadcast throughout the control room. "I think I'm listening to the right," says Floyd. A safety diver appears to adjust his weight. There is a discussion of the "forward sevens" and the "rear fours" clusters.

The time spent underwater was used first to repeatedly build simple structures, then to construct the most complex structure ever built in the Marshall pool. "In terms of learning or productivity, each day we might try a different approach — using a more stable position, perhaps," explains Bowden. "The space suit felt impossible at first, but now, with practice, it's a whole different ball game," adds Akin.

"We outlined 20 test sessions (no one thought we could do that



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many)," he says. "We identified learning curves and basic body dynamics (how a person moves in a space suit). We wanted to find out — and did demonstrate — that a person can work around a complicated structure. And we want to calculate how many kilograms per person-hour can be achieved in space.

"Our assembly time has been good," says Akin — two times faster than they thought it should be. They were justified in thinking that — the suit is very cumbersome.

"We thought when we came here that there would be lots of technical restrictions (we must be tethered to the work stations, for example). This is not true. They said this is your test; run it as you want. But realize what unrealistic aspects you are incorporating into your tests."

Debriefing: words of encouragement and caution

In the debriefing session after each day's test, Jack Stokes shares his observations with the students.

All the participants have gathered with him in a small room near the testing area to go over the day's activities. Mary asks, today, for a critique: "What are we doing and not doing — how could we do things differently?"

Stokes thinks carefully. "You've come in and done as professional and clean a job as anyone we've had here in a long time," he says. "Your preparation is the main thing that was outstanding — your hardware functioned as expected. You didn't really believe that the suits would be that hard to handle, but you came back fast from that problem and learned how to use them. You're close now to being experienced subjects in suits; but not quite. You need more ease in the suit, but you're developing it. And your times are impressive." (The first complex run was one hour and 10 minutes to build the entire structure; on the fourth run the time was down to 54 minutes.)

Stokes pushes back his chair and looks intently at the group of seven students. The two subjects are chilled; they wear their jackets and look exhausted. Other members of the crew sit around the table: Kim Lewis, '82, George Sarver, '80, Bob Silverman, '80, Gardell Gefke, '83, and Mary Bowden.

"Your flexible structure is unrealistic," continues Stokes, "you could never stabilize a structure like that. (Students are test building two types of structures, one flexible and the other rigid.) Your material for the beams is much stronger than the material we use; we would never build anything that massive in space. But we are interested in the operational elements you used, and you're building it fast enough to make it feasible."

To use or not to use tethers (to anchor the worker to his equipment as a safety precaution) is the subject of lengthy discussion.

A decision is made about what will happen on tomorrow's test.

After the testing at Huntsville is completed, the group will reduce data and design new tests, hoping to return to Marshall next summer. Dave and Mary will give a report in Washington, D.C. to explain what they've accomplished and their future goals.

"In ten years we will see them doing the same thing in space," says Professor Rene H. Miller, their advisor. "Indeed, they will have good experience. — M.L.

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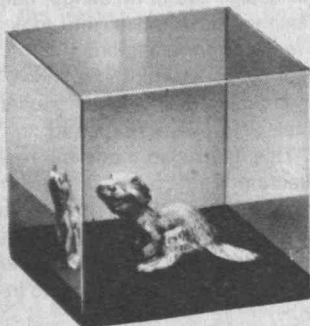
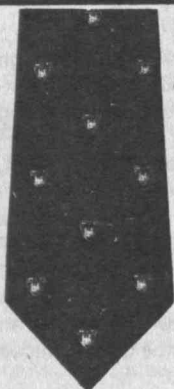
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Agnes Denes, Artist in Residence: Art to Make the Viewer Question

by Mary S. Cowen

What makes an artist tick? What is this thing called an artist?

In January, when Agnes Denes was Artist-in-Residence for a week in collaboration with the Creative Photography Laboratory at M.I.T., students had an excellent opportunity to find out. Ms. Denes discussed her work and answered a multitude of questions in the Hayden Gallery where her work was on display.

The exhibition included drawings, photographs, "aesthetographs", lithographs, etchings and a text of ten years' efforts. A study of distortion series with Earth's continents projected onto various forms, including a doughnut and hot dog shape, stopped passers-by in their tracks, according to Gary Garrels, curator of the show.

Ms. Denes would like "to open up the doors to art." She says it "has been very elite for a very long time. We need to integrate art and technology."

She is appalled at "dehumanization, mind control, and fear dominating human affairs now," and looks for a new Renaissance perhaps a century hence. Meanwhile, "We have to investigate this relativistic world,"

find new insights, and new methods of working, she says.

She has devised a thought-provoking questionnaire for students to fill out so that we may be judged in the future by our answers.

The students asked Ms. Denes searching questions:

What is your concept of reality?

"It is constantly changing. The only reality I can achieve is for a fraction of a second, and it is only a bit of truth."

"How do you see the work being seen?"

"I don't. I see evolution — evolution of the idea, my evolution, evolution of the world around me."

"Why are you subjective and playful about technology?"

"To provoke you to question the status quo, to be open and sensitive. You are curious, ready to receive something. I have to keep myself like that or I shut myself off from all the little nuances."

"Are these pieces visual progress reports of what you're thinking?"

"Yes."

And so on, as the students probed.

What does the viewer get out of her art? "It's a *feeling* that you get from it — if it makes you think or ask questions. In any art experience it's what you bring to it," she explained.

I.A.P. Professional Internships for Architecture Students

by James Moore, '80

How does a prospective architect break into the profession when nearly every hiring firm is looking for candidates with previous work experience? The dilemma is particularly frustrating for undergraduates at M.I.T. because their B.S. in art and design will not qualify them for professional licensing.

When Professor Edward Allen took over as chairman of the Undergraduate Program Committee in January of 1978, he founded a student internship program to provide full-time internships for M.I.T. students at local architectural firms during I.A.P. In return for their volunteered time, interns receive six units of architecture course credit. For many, however, it is the ability to claim professional work experience that is the program's greatest reward.

The original notion of a professional internship came out of an idea brought up by Alex Lamis, '79. "There seemed to be local professional enthusiasm about it," said Allen. Many architects remember their college days and there is a genuine feeling of responsibility among practitioners to assist

in the educational process. Even though they would be dealing with relatively inexperienced students, most of the firms asked were receptive.

First, problems had to be solved. "What, for instance, would be the role of the participating architect? Was he considered a teacher or not? Was he qualified to be one? If so, how was he to be compensated? What course requirements would be removed in lieu of the internship? There was even an issue involving the insurance of off-campus activities," Allen explained.

In order to keep the program accessible to the juniors and seniors for whom it was primarily intended, only one academic stipulation was made: all participating students must have had at least one level-one architectural design studio.

Rather than seeking students with special skills or technical abilities, Professor Allen looks for students who are willing to work. What he offers is a chance for an architecture student to exchange some of his or her vacation time for a potentially valuable educational experience. Twenty-two students the first year, and eighteen students this past I.A.P. were willing to make the commitment.

Both years, feedback from the interns has

been overwhelmingly supportive. "At least three-quarters of the participants felt that the experience was positive," says Allen.

Students with trepidations about the work they would be expected to do generally discovered that their fears were unfounded. The range of tasks the interns performed was extensive: model building, base map planning, sketching, spec writing, detail drafting, and even editing of technical papers. Jobs were often molded to fit the student's ability or preference. Some students found themselves participating in the actual design process, and, as one intern wrote, "I learned that I had ideas a real architect would find worth considering." Interns participated in design group meetings, helped draft preliminary schematics, and took active roles in client presentations.

More than simply learning the "hows" of professional architecture, many students, for the first time, were exposed to the "whats". "This internship made me realize that architecture is much, much more than design work," wrote one student. The four-week experiences allowed students to get a feel for the working day of the professional designer that could never be obtained in the classroom.

Under the Domes

MIT Open House

Over twenty thousand people may converge on M.I.T. Saturday, May, 3, from 12:00 noon to 5:00 p.m. when the Institute holds its 31st biennial Open House. The demonstrations and exhibits presented by the individual departments and laboratories will characterize science and technology's impact on society in the decade ahead. Open House will provide special opportunities for the general public, for parents, and for prospective students to see what happens behind those stone pillars, and for alumni to revisit fraternity houses, renew friendships, and view the many changes on campus.

Brothers in Alpha Chi Chapter of Alpha Phi Omega, National Service Fraternity, are organizing Open House '80. Their Chairman is Judith Frankel '81 and Dean Holden acts as advisor. The entire M.I.T. community contributes to turning the Institute inside out.

The Massachusetts State Science Fair will also be held at M.I.T. on May 3, from 10:00 a.m. to 3:00 p.m. Both events promise enlightening experiences.

Senior Class Sells Beaver Shirt

The popular M.I.T. beaver shirt, previously sold only on campus by the Class of 1980, is now available to M.I.T. alumni by mail order. The Seniors, who are selling the La Coste look alike as a fund raiser, sold over 650 shirts during a sale in December.

The Beaver Shirt, the epitome of subtlety, has an inch-long applique of the M.I.T. mascot, the beaver, sewn onto the left breast. This short-sleeved sport shirt, made of a comfortable 50/50 blend, is available in men's sizes small through extra large. Two colors are offered by the seniors: crimson and white.

The Class of 1980 will use the funds raised in this unprecedented sale for their graduation gift. The senior class gift committee is presently reviewing proposals for the gift, which will be presented on graduation day. — for the Class of 1980: Chuck Irwin, 526 Beacon Street, Boston, MA 02215 (536-0534)



The check is for \$1,000 — made payable to Eric L. Mears, '80, as winner of a contest for designing a car-theft protector. The donor, John C. Anderson (left), a Connecticut businessman, wants to market Mr. Mears' device — which remains undescribed at least until patent questions are resolved. At the right is Professor David Gordon Wilson, who was among the judges.

\$1,000 to Stop Car Thefts

Asked to think about devices to protect cars from thieves, most of us turn to locks for doors, ignition, or steering — or perhaps switches or relays to prevent the engine from starting.

But those solutions are too obvious to thieves, reasons Eric L. Mears, '80. The thing to do is stop the thief after he's started — at a moment of great vulnerability.

Mr. Mears has just won \$1,000 for his suggestion of a device which would gently bring a stolen car to a stop in a safe and controlled manner some distance from the point of the theft. That's all we know: the details aren't being divulged, at least for the present, because Mr. Mears is applying for patent protection.

The \$1,000 prize was from John C. Anderson, a Connecticut businessman, who last spring put up a total of \$1,600 in prizes for M.I.T. students to devise car theft deterrents. Eight other students associated with the Innovation Center and the Department of Mechanical Engineering shared six \$100 second prizes.

Kresge: Cold and Quiet

The workmen have left, and Kresge Auditorium stands empty awaiting structural repairs, which will be made as soon as weather permits, and its new roof, to be applied during the summer. By September, says William R. Dickson, '56, director of physical plant, normal activities will resume.

Kresge was due to close this spring for re-roofing. But the old waterproofing had failed earlier than anyone knew, and seepage had deteriorated part of the roof structure by late last summer. So the building was suddenly closed last fall.

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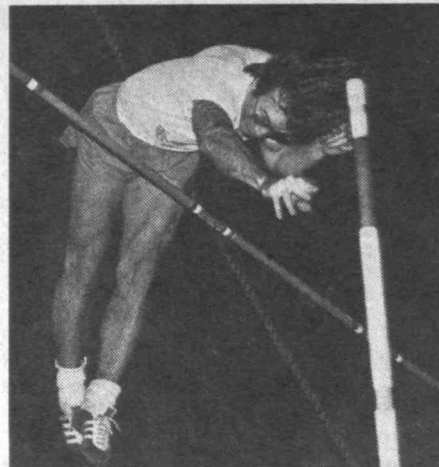
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Dave Wilson, '73, soars up and over the bar to set meet and Rockwell Cage records of 15'9" in the pole vault at the M.I.T.-Alumni track meet on December 15. (Photo: Brian Moore, '73)

The Alumni Shine — But Not Quite Bright Enough — in Track

It took eight years, but Dave Wilson, '73, finally broke his own Rockwell Cage record in the pole vault at the seventh annual M.I.T.-Alumni indoor track meet on December 15.

Wilson soared 15'9" for the new meet and Cage mark. The previous record was 15-1, set by Wilson in 1971; he holds all of M.I.T.'s indoor and outdoor records in the event.

"I wasn't really feeling all that well before the meet," said Wilson. "I had a slight touch of the flu and conditions in the Cage weren't exactly the best. But things turned out all right, didn't they?"

Coach Gordon Kelly's varsity squad edged the grads (60-53) for their sixth win in seven meetings. It was an exciting meet with several outstanding performances by both squads.

Kwaku Temeng, '79, captured both the long jump (21-9, a meet record) and 50-yard dash and was second in the triple jump. Brian Moore, '73, won both the 35-pound weight throw and shot put in his first competition in two years. Other meet records were set by freshman sensation Paul Neves in the 1,000-yard run and by Harold Hatch in the open master's mile.

The alumni had a 39-15 advantage in the field events, but the varsity's 45-14 dominance in the running events proved to be the difference.

"Still, it was a fun meet; and next year we think we'll put together another fine showing," said Wilson, who is a graduate student and part-time assistant coach at M.I.T.

Meanwhile, former M.I.T. track all-American Frank Richardson, '77, made big sports news when he won the Masson Marathon (26 miles, 385 yards) in Saratoga, Calif., on January 27 in two hours, 13 minutes, 54 seconds. — Ken Cerino

12

Ham Merrill writes that he and Phyllis are busy enjoying themselves and are active in their church, playing bridge, garden club activities, and the M.I.T. Club of Cape Cod. They are well and as Ham writes "can think of discomforts, but have enough baling wire to hold important parts together." Their daughter Winifred has married again and they now have five more step-great-grandchildren. Like the rest of us, Ham resorts to checks for family Christmas gifts and now is up to 22 with the attendant exhaustion of arm and wallet. . . . **Harold Mitchell** reports that his activities since retirement have mainly been directed toward conservation, conservation organizations and politics. — **Phil Dalrymple**, Secretary, 59 Boulder Rd., Wellesley Hills, MA 02181

13

We hope your holidays were happy and that the New Year will be healthy and happy also. Here in Maine (supposedly snow country) we have had little snow whereas southern and mid-western states have had more than their share. I'm not a skier so I like the clear roads.

We thank **Allen F. Brewer** for his timely letter after Hurricane David last fall and quote both letter and poem:

"Both Maurine and I are fine. We weathered David successfully tho we did have a couple of scares. Once we ventured out into the winds to secure a flappy metal awning. No luck: the awning took off and wrapped itself around a tree before landing on our neighbors' lawn.

"Here are a couple poems which I have written pertaining to hurricanes. I tried to walk against the 90-mile winds. The winds won. I had to get down on my hands and knees to crawl back to the house.

"This year has been kind to us. I did have a couple of skin cancers surgically removed from my face, but it did not mar my 'phisog' so to speak. Lots of elderly men get these blemishes when they stay out in the sun too long — like 'mad dogs and Englishmen' as the song goes.

"Not much travel these days. We did fly to Pittsburgh, however, in June for our granddaughter's wedding. She's the gal I may have told you about who is specializing in languages. Has her bachelor's and master's in Latin languages, and now is studying for her doctorate in Russian while teaching at the University of Pittsburgh.

"We hope you folks are well prepared for the forthcoming cold weather. Most folks here are all electric, but the bills are scary."

Allen has also sent us a book of original poems from which we will quote from time to time. We are most grateful, Allen.

C. Lalor Burdick writes: "Since retirement from the DuPont Company, after 30 years' of service in research and administration, my major activity has been directing the Lalor Foundation (which supports post-doctoral basic medical research in

The Benefits of David by Allen F. Brewer

Young David slew Goliath with a pebble from a sling.
King David planned the psalms of praise when he became the king.
Now David of the hurricanes brought blessings in disguise.
It's taught us to be ready when the storm breaks through the skies.
We've learned the wisdom to prepare for things we hope won't happen.
We've learned to "play safe" and trust in faith, with doors and windows battened.
We've learned respect for wind and wave, and floods brought by the rain;
We better know how to prepare when crisis comes again.
But every storm cloud, so they say, comes with silver lining;
Our day is no exception, — when the morning sun is shining.

the field of mammalian reproductive physiology). "My wife is the vice regent for Delaware in the Mt. Vernon Ladies Association, which has owned and operated this nationally important historic shrine for more than 125 years. So we have both been involved with the maintenance of this monument and estate. Similarly, committee work for Winterthur Museum and the University of Delaware has been our lot.

"We travel a bit, visiting abroad at least every other year, mostly to encounter current Lalor Foundation Fellows.

"We are presently building a new smaller home, but large enough for visits from our son, daughter and four grandchildren. Please note our new address: 900 Barley Dr., Barley Mill Court, Wilmington, DE 19807."

We have been notified of the death of **Everett St. John** on Nov. 1 in New Long, Conn. He was with the Bell Telephone Labs over 40 years and had many patents to his credit.

Until next time. — **Rosalind R. Capen**, Assistant Secretary and Treasurer, Granite Point Rd., Biddeford, ME 04005

14

Ray P. Dinsmore, our president emeritus, died on October 26, 1979, at the age of 86 in Akron, where he had lived for nearly all of the past 65 years. He was a member of our class from the beginning and graduated with us in Course X. In the same year, he joined the experimental department of Goodyear Tire and Rubber Co., in Akron, then was a chemist at its Canadian plant, and in 1919 became its chief chemist in Los Angeles. He returned to Akron in 1921 as Goodyear's chief

chemist and research director. After holding increasingly important positions, Ray was elected vice president for research and development in 1943, and when he retired in 1961 he was also a director of the corporation. Among Ray's many achievements were the invention of Pliofilm, new methods of processing synthetics, and the development of rayon tires, electrostatic air filters, and a synthetic rubber of the same composition as natural rubber.

In 1928 Ray patented the first water-emulsion synthetic rubber in the United States — the synthetic vital to the nation's need for rubber in World War II and the backbone of the synthetic industry. Ray also played an important part in the direction of national rubber production during the war. He had a leading part in Goodyear's advances in plastics, aviation products, films, flooring, foam, and footwear products. In 1947 he received the Colwyn Gold Medal of the British Institute of the Rubber Industry for his wartime achievements in synthetic rubber, and he was awarded the Charles Goodyear Medal of the American Chemical Society in 1955.

Ray held an honorary doctorate in engineering, conferred by Case Institute of Technology. He wrote extensively in his field, and was president of the American Institute of Chemists from 1955-56. Ray was a trustee of Kent State University from 1959 to 1966, and was a member of the M.I.T. Corporation from 1954 to 1959. He was elected president of our class at our 50th reunion and held that office with distinction until his declining health led him to feel that, at our 60th, he must offer his resignation. It was accepted with regret, and Ray was made president emeritus in recognition of his services to the class. Ray is survived by his wife, the former Violet R. Cowie (they had been married just over 60 years); a daughter, Mrs. Ruth Ayers of Metuchen, N.J.; a son, Ray P. Dinsmore, Jr. of Barrington, Ill.; and four grandchildren.

Howard G. Borden has a new address: 326 W. Bridge St., Yardley, PA 19067. — **Charles H. Chatfield**, Secretary, 177 Steele Rd., West Hartford, CT 06119

15

65th Reunion

Our class has suffered a sad loss in the passing of **Archie Morrison**, who died December 19. He had lived in a nursing home in Lexington, Mass., for the last few years. Several of us had visited him regularly. Arch was a regular and generous supporter of all class and alumni activities. He attended every class meeting and reunion we had. Arch was a fine old friend. We'll all miss him. We have written his nephew, Howard (Jr.) in Lexington, Mass.

How does she do it? **Mary** (Mimi, now) **Rice** writes of her travels and activities — truly a remarkable lady: "Sorry there will be no five-year reunion this year — but of course I understand. I plan to join the general reunion and the one at Harvard and of course will surely see you somehow. I'd like to stay a week at McCormick Hall lingering after the reunion days and renewing old

scenes in Boston, as I'm sure this will be my last trip to Cambridge. Here nights are cold; I have difficulty finding California the sunny, warm state of my younger days. However, every one is friendly in this lovely mobile park with beautiful flowers blooming all winter. I hope your surroundings are as pleasant as mine." Those of us who can be there in June will welcome Mimi and be glad to see her.

In January **Wayne Bradley** left for his annual trip to Florida. Wonderful how he keeps it up. He wanted to recover from a long stay in the famous Mary Hitchcock Hospital at Dartmouth. We all wish him well. I always enjoy seeing him on his trips to Boston.

As a reminder of our dim and distant past, **Evens Burtner** sent his clipping about our old "Technique Rush" on the site of what is now the Copley Plaza Hotel. Remember?

"Around 1915 it was customary for the junior class at M.I.T. to publish in the spring a bound book, the *Technique*. This gave individual pictures of the candidates for graduation that year with a statement listing membership in fraternities, their activities in sports, professional societies, home towns, etc.

"In 1914 our class had published *Technique* and issued special copies signed by M.I.T. President Dr. MacLauren through a slot in the roof of a small portable shed. That year it was set up against the back wall of the fairly recently constructed Copley Plaza Hotel. Two of our prominent 1915 classmates, **Fannie Freeman** (of small stature) and **Brite Crowell** (a bushy chap) stood on top of the shed to monitor the event, possibly to shoot the starting gun. Contestants for the honor of getting the first copies were lined up, perhaps 150 feet away.

"At the start signal the line of undergrads, some with shirts off, rushed for the shed. With the taller having an advantage to reach the slot in the roof, there was a fierce impact from this wall of men, causing one section of the roof to fall in. And behold! it was lightweight **Fannie Freeman** who disappeared like a hog taking off, his legs lost from view. Fortunately, he was unhurt — perhaps landing on fellow classmates below. Husky **Brite Crowell** stood or remained unaffected. Such is life.

"It is true my driving is limited so M.I.T. is only visited about once a year. However, lets hope we will have a good representation at Alumni Day, 1980. I am here for two months soaking up sunlight. I do miss my old-time walking ability."

We're all glad to learn from **Evens Burtner's** letters that he is enjoying the winter in Florida and that he remembers his classmates. Note my address change. I have been living in Wellesley with an old friend. Much better than my lonesome existence in Cambridge. Don't get old. All the best to you all. — **A. W. Mack**, Secretary, 7 Altwood St., Wellesley Hills, MA 02181

17

A very nice letter at Christmas from **Hobart Stebbins** from Bellevue, Wash., giving a good account of his family of 22, including children, grandchildren, and great-grandchildren, all well scattered over the country. Hobart, Sr. is presumably retired but his wife, Edna, says he goes to the shipyard that he founded every day. He says the problem of managing a small business and coping with all the government regulations today are almost impossible. Hobart, Jr. and his wife, Jennie, live nearby as he carries the load of managing the shipyard, where their two sons also work.

Hobe, Sr.'s daughter, Dorothy, and her husband, Charles, live in New Hampshire and commute daily to Boston. Their daughter, Debbie, is married and lives near her grandparents in Washington. She has a daughter, Alisha, the first great-granddaughter, and Hobe and Edna try not to spoil her. Dorothy's eldest daughter, Chris, lives in Cambridge, Mass., with her husband, Andy, who attends Harvard Divinity School. Hobe's son, Robert, and his wife, Elinor, live in Greenwich, Conn., and have five children. So

Hobe's family is widely scattered and gives him and Edna many interests. Last year they celebrated their 61st wedding anniversary.

I heard from **A. P. Sullivan** in December. He had just had another visit to the hospital with a virus infection, but recovered in a week and is now well and at home. His phlebitis in the right leg has improved so he can walk now with a cane. He says Olive is very well and happy.

Edna and **Brick Dunham** have left their lovely Wellesley home of 36 years to live at a retirement home. The address is 1007 East St., Dedham, MA 02026. ... The **Stan Lanes** left in January to spend three months at Boca Raton, Florida.

A letter from Mrs. Judith Duryea says that her husband, **George R. Duryea**, had died on Oct. 23, 1979. Their home was at Mountain Lake, Lake Wales, Fla. George was born in Buffalo, N.Y., and was the son of J. Frank Duryea, who built the first automobile in the U.S. George served in the Navy in World War I and was the retired president and owner of the Lincoln Lubrication Co. George leaves his wife, Judith, two daughters, and his son, George, Jr., who is also an M.I.T. man.

The December 12 issue of the Institute *Calendar* notes that the first holder of the **Thomas Meloy** professorship in rhetoric has been appointed. She is Dr. Irène Taylor and received her three degrees from Stanford University: B.A. in philosophy, M.A. in American literature, and Ph.D. in English literature. She first came to M.I.T. in 1976 as an associate professor of humanities.

Bill Neuberg, dean of the "low-brow" table at the Chemists' Club in New York, is reportedly the second member in longevity. ... Jeanette and **Stan Dunning** spent Christmas in Maryland and **Ray Stevens** on Sanibel Island, Fla., with his son. ... Your secretary had a successful eye operation in January. — **W. B. Hunter**, Secretary, 711 Farmington Ave., Apt. B-9, West Hartford, CT 06117

18

The seventies have come and gone and now to the eighties. Just before the end of the decade I sent you greetings for the end of the old year and the beginning of the new one. I am touched with the response from many of you including **Ben Greely**, Rhoda and **Charlie Tavener**, **John Kiley**, Wilfred and **Sumner Wiley**, **Wilfred Holt**, Margaret and **Paul McAllister**, Tom Knowland, Marie and **George Sackett**, and Mildred and **Charlie Watt**. Beulah and **Bill Foster's** greetings were in the form of a most handsome and useful 1980 diary.

A note from Eleanor Kilduff tells that **John** is still in a nursing home in Clearwater, Fla., and is interested in all news about M.I.T. and the class of 1918. ... **Herb Goldsmith's** good wishes from Tucson, Ariz., includes a P.S.: "Your interesting card showing the new Stratton building at M.I.T. was well worth putting on display." ... **Ed Little** was most gracious with his good wishes for 1980. ... **Len Levine** writes: "What does M.I.T. mean to me? It makes me feel that I am a member of one of the finest and best known organizations in the world and that the training I received was invaluable." ... **Ted Braaten** notes that our knowing each other more closely as the years go on makes M.I.T. that much more to be desired. ... **Ural Baber** includes in his card some special recipes to make the season more enjoyable. ... **Art Williams** writes, "M. I.T. has meant much to me in many ways. It's still at the top of my list."

Granville Smith tells of a bus trip to New England during the summer. He recovered from a fracture of the spine received during a Florida hurricane. There was much family activity — particularly during the Thanksgiving holiday. ... **Herb Larner** concludes his year and yesterdays with the following: "The poet Horace is supposed to have said, 'Though the populace may shoot me, and the people miss me, when I go home and count my money, I applaud myself.' Since money has never been the most important thing in my life, in considering your thought provoking question, I will paraphrase the observation of that great writer: No matter what the future may hold for me, I can always look up to my M.I.T. diploma

and congratulate myself."

Edgar Goldstine's good wishes are as follows: "Season's greetings to you! In looking back on my post graduate studies, the names of Professor Swain in structural engineering and Professor Jackson in electrical engineering stand out particularly. What they taught was particularly helpful in my later work. Enjoying reasonably good health and doing very little of consequence."

The following letters from the families of two of our classmates record their passing. Mrs. **Joseph Herzstein** wrote: "Many thanks for your holiday greeting. I am sorry to say Joseph passed away on February 1, 1971. The item was carried in the medical journals, but I can understand why M.I.T. did not receive any notice." ... From Mary Lutz **Money**: "My father, **William Lutz**, passed away last August 29 at the age of 86. He had a long, healthy and full life. I was in Japan the years he spent in Korea and Okinawa. I'm sure he had many happy memories of M.I.T. days, for he was happy in his work as an engineer and builder."

A note from the Alumni Records tells of the death of **William Laskey** on July 7, 1979. If any of you have any information about Will and his career I would like to include it in the next Notes. ... I regret to report the death of **Peter Strang** on December 18, 1979. It was my privilege to have been in active contact with Peter for many years. He was active in the textile industry. He was a most loyal member of our class. We shall miss him. — **Max Seltzer**, Secretary, 60 Longwood Ave., Brookline, MA 02146; and **Leonard Levine**, Assistant Secretary, 519 Washington St., Brookline, MA 02146

19

Your Secretary regrets to report the disappearance of my class notes folder. I have been deeply involved in a protracted take over of a town bank of which I was chairman of the board. In the mountain of papers that such a matter involves when three law firms are at work it appears my class notes got entangled and disappeared. However if you will bear with me we will at least "show" in this issue and now with much more time at my disposal there should be a marked improvement.

Notes do not seem to pop up without solicitation. You will be hearing from me — so lend me your ear and send me a note or two.

Many of you remember **Horace W. Denison**. Horace died on August 23, 1979, after a brief illness, in the Cardinal Cushing Hospital in Brockton, Mass. Two sons survive: Thomas and Jack.

A short note from **George Michelson** who did such a superb job with our 60-year class reunion. Our account in a Boston bank was closed out and I am glad to report a small balance as a nest egg for our 65th, which I hope to attend. George writes that he has "been feeling first rate and managing under my new life style — there is no alternative." — **W. I. Langille**, Secretary, Box 144, Gladstone, NJ 07934

20

60th Reunion

Christmas cards and notes from classmates far and wide have been received with appreciation and gratitude: from Betty and **Norris Abbott**, Mary and **Buck Clark**, Marge and **Stan Reynolds**, **Ned Murdough**, **Frank Badger**. ... Florence and **Lee Thomas** will be spending the winter at Naples, Fla. ... Barbara and **Bill Dewey** report that they flew out to Colorado Springs last fall to attend the wedding of their grandson, who recently graduated from the U.S. Air Force and is completing his pilot training.

A good letter from our valued classmate, **Johnny Barker**, of Portland, Maine, says that his health will not permit attendance at the reunion. He states that he has led a quiet life since his retirement in 1964 as executive director of the Maine Medical Center, taking occasional winter trips to Florida and in summer to his cottage at Sebago Lake. John's grandson, a graduate of Worcester Tech and now with Digital Equipment Co., recently lectured to a gathering of M.I.T. fac-

ulty members on his company's computer systems. He has presented John with his first great-grandson. John has three other grandchildren, all nearby. He asks me to extend best wishes to his classmates and expresses regret at not being able to join them.

Another welcome letter from **Frank Maconi** tells of his rewarding activities in SCORE and in a planning seminar for retirement under the auspices of the Fitchburg C. C. Frank says he has given up his successful "country store," with its 43-year collection of a thousand or so items, some of which are on display at the Museum of our National Heritage, in favor of his three grandchildren. . . . It is also pleasant to have heard from **Dick Gee's** widow, Billie, and **Homer Homes' Vera**. While in St. Louis, en route to San Diego, we had a fine telephone visit with Vera and she sounded in good spirits.

Returns are now mostly in from the Reunion mailing and I must say they are very encouraging. They promise a good attendance at the 60th. A follow-up mailing which is now in the works will give details as to costs — moderate, I must say. We'll also include a list of those planning to attend, which should serve as inspiration for some of you still on the fence. Incidentally, Norrie and I are developing a "souvenir" of the occasion which we think will be worth coming to get. Included in the returns were notices of two recent deaths: **Walter Warner** of Barrytown, N.Y., on December 13, and **Fred Crapo** of Munice, Ind., who died in an automobile accident on December 3. I am sure I speak for the class in expressing a feeling of loss that these good classmates have departed from our ranks.

We are looking forward to meeting and greeting many old and dear friends at the 60th. Do write and tell me you are coming. — **Harold Bugbee**, Secretary, 21 Everell Rd., Winchester, MA 01890

21

Betty and I wish to thank those who sent us Christmas greetings, particularly if these brought us family news. We heard from **Helen St. Laurent**, Beth and **Whittier Spaulding**, Ruth and **Irving Jakobson**, Emma and **Al Lloyd**, Dorothy (Mrs. Joseph) **Wenick**, Betty (Mrs. Norman) **Patton**, Marianne and **Grant Miner**, Vivian and **Leo Pelkus**, Ann and **George Schnitzler**, Claudia and **Josh Crosby**, Marion (Mrs. George) **Chutter**, Maxine and **Cac Clarke**, Hazel and **Whitney Wetherell**, Graciela and **Heller Rodriguez**, and Helen and **Bob Miller**.

Helen St. Laurent said she was away for four months this past summer, spending two months each at Center Lovell and Vinalhaven. She is busy and well and was spending Christmas with friends. She inquired if I had any news of **Ed Farrand**. The answer was "no." How about it, Ed? . . . **Irv Jakobson** is doing some cruising again this winter in the Virgin Islands. "Takes years off my life," says he. . . . The Lloyds had a houseful of 16 children and grandchildren in Westerly this past summer. Al is active as legislative chairman of the local AARP, involved in two critical concerns — state insurance rates and fighting efforts to close their 140-bed hospital. . . . **Dorothy Wenick** wrote: "Moving to Florida was an ordeal but both sons were very helpful and drove me down. Leaving Caldwell and dear friends was very difficult but I realize living here will be much easier and better for my health." . . . **Betty Patton** reported "a very happy and contented year — continuing interest in my job at the Temple — five wonderful days last February in Scottsdale, Ariz. — and delightful weeks last summer on Cape Cod and at Lake Megunticook in Maine." . . . **Horace Tuttle** is still active in a senior citizens' group in Bloomfield, Conn., participating in a variety show (song, dance, musical instruments). . . . **Leo Pelkus** feels fine and lowered his golf handicap by two strokes. **Marian Chutter** wrote that she enjoyed seeing Helen and **Bob Miller** in the spring and fall on Cape Cod. She still drives her car. Bob Miller's card was another photographic triumph with six pictures and summaries of the various families' activities.

Elliott Roberts of Westmoreland Hills, Md. wrote: "I saw in the Dec./Jan. column that you know of two members of our class who have written stories for children. I think you should know that I have been the author of three books of science explanation for juveniles — not children. These three all dealt with earthquakes and volcanoes. I have also been the author of more than a hundred articles on science, biography, and essay subjects. I have been editor of a journal published by the Explorers Club for some 12 years or so, this dealing with geographic and exploration subjects. Currently I solicit, edit, and sometimes write short vignettes about members of my club — the Cosmos of Washington. Who says engineers are not literate?" — **Sumner Hayward**, Secretary, 224 Richards Rd., Ridge-wood, NJ 07450; **Josiah D. Crosby**, Assistant Secretary, 3310 Sheffield Cir., Sarasota, FL 33579; **Samuel E. Lunden**, Assistant Secretary, 606 S. Olive St., No. 701, Los Angeles, CA 90014

22

As we consider these notes in January, we must tell you that Buffalo is that place that winter forgot. However, your secretary and his constant companion are leaving for Florida anyway. Next comes first hand information on **Parke Appel**, **Frank Kurtz**, and others.

Bertha S. W. Dodge of Burlington, Vt., is considering retirement, but not very seriously. She writes: "My activities center about my typewriter and this year the results of previous years' work show up. Last April, Wesleyan University Press brought out *Marooned* which I dug up, researched corroborative material, and wrote a lengthy introduction for and edited. Had a nice review in *The New Yorker*. In January, McGraw-Hill will publish my book about some plants which have exercised profound political effects through their products. The title — *It Started in Eden*. Then will come a book published by the University of New Mexico Press, *The Road West: Saga of the 35th Parallel*. Title self-explanatory." Congratulations to Bertha.

Lloyd A. Elmer of Summit, N.J., has formulae for integer hypotenuse of infinite number of right triangles with integer sides (altitude and base) and suggests that *Technology Review* might be interested in his thesis.

A day-long event at the Spalding Inn Club in the White Mountains at Whitefield, N.H., honored "The Enterprise of the North Country of New Hampshire." Panel discussions and exhibits provided a unique opportunity to share in the appreciation of its history and future prospects. The key-note luncheon speaker was New Hampshire Governor Hugh J. Gallen; other speakers included **Randall Spalding** of our class. Randall also is president of the Bowling Club. We hope to be invited again to this beautiful area in the future.

We have beautiful greetings from Vickie and **Edward Merrill** from their new home at 2323 Laguan Street, Apt 301, San Francisco, CA 95115. We remember with pleasure our golf game at the Spalding Inn in 1977.

We are happy to have a nautical picture of Kate and **Mac McCurdy** at the dock in Seattle ready to enjoy a winter cruise before leaving for Palm Springs.

We are sorry to receive the news of our loss of **C. Lauren Matby** in July 1979 in Sierra Madre, Calif. His wife, Betty, has written a resume read at the memorial service at the Methodist Church which was most comprehensive. Lauren finished law school in Chicago and practiced patent law thereafter for 45 years in Chicago and Los Angeles. While at M.I.T. he had assembled the first car radio in 1920 and later while practicing patent law in Los Angeles was successful in patenting the first tape recorder.

The sympathy of our class goes to the family of **Clyde A. Benson** of Winthrop, Me., who passed away in May, 1979; and **Edward L. Lincoln** of North Adelfurrow, Mass., whose death occurred in August, 1979. Ruth J. Alan, daughter of **H. Richard Alan**, has informed us that he passed away in July, 1979. Her address is 2100 Jackson St., San Francisco, CA 94115.

We are sorry to report the loss of **Harlan A. Wilbur** in July, 1979, a leader in the development of offset lithography in New England. He had received a law degree from Northeastern University in 1942 and was president of Graphic Litho Co. in Lawrence, Mass.

We are sorry to lose from our class **Osmond S. True** of Westwood, Mass. He was a retired engineer from the U. S. Rubber Co. and had lived in Westwood for the last 25 years.

We are sorry to report the loss in July, 1979, of Colonel **Olaf P. Winningstead**, 125 Rantool Cir., San Leandro, CA 94577. Our sympathy goes to his family.

A warm, comfortable winter to you all. — **Whitworth Ferguson**, Secretary, 333 Ellicott St., Buffalo, NY 14203; **Oscar Horovitz**, Assistant Secretary, 3001 South Course Dr., Pampano Beach, FL 33060

23

Rod Goetichius has appointed **Pete Pennypacker**, **Tom Rounds**, **Royal Sterling**, **Lem Tremaine**, with **Dick Frazier** chairman, as a study committee for the revision of our class constitution. The principal objective of the proposed revision is to provide for the ultimate disposition of residual class funds, though the opportunity will be taken to propose certain other revisions at the same time. The proposals will go first to our advisory committee for review, and then after possible further adjustment by the study committee, to the entire class for a vote.

Bert McKittrick writes that he and Harriet, Mary and **Royal Sterling**, and **Frank Travers** represented '23 at a meeting of the M.I.T. Club of Palm Beach County on January 10, and adds, "The president-elect, Dr. Paul E. Gray, spoke and it sounds as if we have a winner!"

Two deaths have been reported by the Alumni Office. **Nathaniel O. Robinson** died on August 26, 1979. He graduated in engineering administration with our class, and became a management consultant associated with Brown and Co. of New York City, from which he had retired to his home in Woodstock, New York. . . . Colonel **Robert Sears** died on January 9, 1979. He was a West Point graduate, took post-graduate studies at the Institute, and affiliated with our class. After completing his studies he served as colonel in the United States Army stationed at Watertown Arsenal and at other locations.

We have just learned also from **Bert McKittrick** that **Peter Petersen** died on August 28, 1978, in Bergen, Norway, from cancer. Pete was born in Bergen in 1902, graduated with our class in civil engineering, and worked in this country until about 1936 when he was called home upon the death of his brother to take charge of the family business, Giertsen and Co., engaged in fishing, fish industry, and export. He also became a member of the board of Norsildmel, sole selling organization for the Norwegian fish and meal oil industry; chairman of the board of Bergen Fiskeindustri, a major freezing plant; president, Industrial Association of the Fish Meal Manufacturers, comprising all the major producing countries; and member of the board of Fish Meal Exporters, comprising the major fish meal exporting countries of the world. His hobbies were gardening, nature study, mountain climbing, fishing, and shooting. — **Richard H. Frazier**, Secretary/Treasurer, 7 Summit Ave., Winchester, MA 01890

24

Dick Shea writes from his transplanted hacienda in Venice, Fla., that in November, "Helen and I have just returned from a four-day cruise in the Emerald Seas to Nassau and Freeport. Now trying to lose gained weight."

We have word from Archer M. Nickerson, Jr., '25, of the death of **Elliot P. Thayer** on December 5, 1979, in Weymouth, Mass. He earned his S. B. in naval architecture and marine engineering and joined the shipbuilding division of Bethlehem

Steel at Quincy, Mass. When it was sold in 1963, he became a member of J. E. Bowker Assoc., a consulting group, until 1972. Elliot was a credit to his profession and it is said, "He knows exactly what a ship should look like." He was an accomplished musician and member of the Tech Show orchestra. Many descriptive articles concerning Bethlehem Steel were authored by him.

A Christmas card, in color, pictures the seemingly ageless Allora and Clint Conway seated at the picture window of their 14th floor apartment overlooking Clearwater (Florida) harbor and islands. "We certainly had a fine reunion this year and enjoyed everyone and everything. We were neither too tired from moving nor too old and weak to stand, but used a low profile, so you might see the view we enjoy."

Colonel John V. O. Weaver, Sr. USAF (Ret) of Annandale, Va., passed away November 2, 1979, after a long illness. He attended the Institute after WWI, attained his S.B. in mechanical engineering and pioneered in civil aviation and industrial air conditioning systems. Prior to WWII, he returned to military service and designed hydraulic aircraft systems including that on the B-29 bombers. Shortly after 1946 he became chief of staff at the Industrial College of the Armed Forces, Fort McNair, Washington, D.C. After retiring from the Air Force in 1958, he became building manager for the CIA until 1972. Colonel Weaver was a founding member of the Order of Daedalians.

Sam Helfman erupts from Louisiana — "Semi-retired. Working on economic feasibility studies of vacuum residue synthesis-gas combined-cycle electric generating plants (under DOE grant). Am active in synagogue and Jewish Welfare Federation work and occasionally play what looks like golf — at a distance. Gardening (my motto: 'if it's less than a foot high, mow it down')."

Phil Blanchard, our Class President, is absorbing solar energy at the Mountain Lakes Club, Lake Wales, Fla. On April 1, he will return to New Haven, Conn. hoping that OPEC has not closed the valve on his oil suppliers.

We have just received word that Leland O. Ludwig, Jr. died January 14, 1980, in Houlton, Mass. A week earlier he suffered an accident in his home. Lud received his S.B. in engineering administration and joined the Stanley Works, New Britain, Conn., where he and Frank Shaw became lifelong friends. In 1929, returning to his home in Houlton, he became associated with the Houlton Savings Bank and established Petroleum Products, Inc. Impressed by the ability of a Texaco gasoline to power a car up Cory Hill in Brookline, Mass., he established a distributorship in the wilds of Maine, which has expanded to supply petroleum products to the Great Northern Paper Company, Maine potato farms, and 33 retail outlets. — Russell W. Ambach, Secretary, 216 St. Paul St., Brookline MA 02146; Herbert R. Stewart, Co-secretary, 8 Pilgrim Rd., Waban MA 02168

25 55th Reunion

It is time to be making reservations for the 55th Reunion activities. Don't delay — the committee members will appreciate early returns.

These notes are the first prepared since the holiday season and allow me to acknowledge greetings received from a number of classmates in widely separated locations. The Drews wrote from Florida, the Washingtons from Washington, D.C., and the Kametanis from Japan. . . . The Kussmauls reported that they were about to take off with their mobile home for a three month stay at Boynton Beach in Florida. . . . George "Count" Blonsky is still in New York City and presented some of his philosophical thoughts. . . . The Spikers were about to leave wintery New Hampshire for an apartment at the Longwood Towers in Brookline, Mass.

Greetings were received from Henry Sachs with a report on his activities for the past year. He and Bee are looking forward to the reunion in June. Henry still has his active insurance business and Bee does part-time consulting at the Graduate School of Social Work at Columbia University. Their schedules are thus quite flexible and

many vacations are possible with the proviso that they not be away for more than three weeks at a time. Henry and Bee were in France in November, mainly visiting the wine auction, and spent three glorious days in Beaune (Burgundy). Also, they spent time in Paris, the Champagne District, and Alsace. Henry is a gourmet and having done a lot of eating and drinking he now rates the Alsace as the gastronomic capital of France. Plans have been made for taking a small segment of the Royal Viking Sea's around the world cruise; getting on in Los Angeles and debarking at Hong Kong to return by air from Tokyo. In March they plan for three weeks in Cuernavaca, Mexico. Last year Henry had a double cataract operation. All went well but as often happens the soft contact lenses caused problems but these difficulties have now been solved completely.

A note from Russell Grove in Marietta, Ga., states: "Maybe not running but I'm the senior lawyer in the circuit and still going!" . . . Joe Russell reports from Houston that his activities have been limited this past year because of long stays in the hospital for extensive surgery and treatments for aneurysms and lymphoma. He is still hoping to attend the reunion and to play golf and tennis again. I'm sure all of us are hoping with him.

A news release from the American Society of Mechanical Engineers reported that Morrough O'Brien, known to most of his classmates as Mike, is still receiving honors. At the ASME annual winter meeting in New York, December, 1979, Mike received honorary membership. He was cited for his "participation in professional engineering societies, innovative leadership in university education, important contributions to engineering practice in several fields including coastal engineering and service to public agencies in technical problems."

The death of Cyrus Fernald was reported in my last notes. The actual date of his passing was October 10, 1979. After Cy graduated he went to work for the DuPont Co. at their plant in Newburgh, N.Y., where he developed an incentive wage plan. However, he took a two-month travel leave and while away his plan was tried in another department where it did not work as he had forecast and the whole plan was thrown out. Shortly thereafter he resigned from DuPont and returned to Wilton, Maine and with his father put into practice, quite successfully, some of his financial management planning learned at M.I.T. In 1933 Cy took a correspondence course and then passed the examination of the Maine Board of Accountancy. He practiced until 1976. Cy was interested in astronomy as a youngster and with the assistance of his wife Emily he established himself over the years as a top amateur astronomer. They were great bird watchers and each of them had 452 birds on their life lists. — F. Leroy (Doc) Foster, Secretary, 434 Old Comers Rd., P.O. Box 331, North Chatham, MA 02650

26

I have been asked by our class officers to assume the role of Acting Secretary of the Class of 1926. Certainly to succeed George Warren Smith is somewhat akin to a rock singer following Caruso, but at least I'll give it a try.

First, at the risk of accusations of immodesty, I'll update my classmates on my own activities in recent years. In 1967 after 37 years with A & P, I resigned my position as director of operations of the New England Division. For some years, and particularly after the death of John Hartford, the company policies had become so ultra-conservative that its competitive position was declining very rapidly to the point that I could no longer have faith in its future. The history of the past 10 years demonstrates what happens to a company or institution which fails to meet changing conditions.

After a year of golfing, travelling in Europe and Latin America, I decided to go back into my first-love career and became a construction engineer again on a number of major public projects which culminated in representing the University of

Massachusetts in the construction of its 130-million dollar Harbor Campus from design, begun in January, 1970, to completion and occupancy in January, 1974.

Since then I have remained as consultant and director of planning in the office of the president of the University of Massachusetts. Many interesting and challenging projects have developed including the planning with the Kennedy Corp. and I.M. Pei of the Kennedy Library located on our campus land in Boston and the oversight of construction and capital outlay projects of the University, which includes also the Worcester Medical Center and the Amherst Campus.

During the past 10 or 15 years, as our three children have been married and on their own, Evelyn and I have had the opportunity to travel through Europe, Latin America, Africa, Asia and the Far East, leaving a few areas which we hope to explore in the next few years. All in all, it has been an exciting and rewarding period.

A few weeks ago while lunching in a downtown Boston restaurant I heard a familiar voice. At the next table I saw Marvin Pickett lunching with a very attractive young lady who (so Marvin informed me) was his secretary at Camp, Dresser, and McKee, where he is still working on a part-time basis. . . . Donald Chase is "still enjoying life in Yarmouthport, Cape Cod. Doing the usual retiree activities of golf, bowling, fishing, clamming and even going oystering at 6 am. tomorrow. The tide waits for no man."

We have just received notice of the 1980 Mexican Fiesta — an event we have always wanted to attend. Unfortunately, we had already planned and confirmed reservations for a trip to Mexico City and Baja California which is scheduled to end a week before March 20, the date of the Fiesta. However, we hope that Louis Darmstadt, Bob Dawes, J.B. Goldberg, and Henry Jones, who are scheduled to attend, will be accompanied by another group of '26ers.

A card from Bill Hoar says: "I don't know where you went this time, but I bet you didn't get kicked out! My family is well scattered. One daughter is in Saudi Arabia with her husband — their children are in school in Florida and Switzerland; my other daughter is in Illinois with her children after the quick return to the U.S. from Karachi, Pakistan on Friday, November 23 (and I with them); elder son's widow and children in Vermont; younger son and his wife in Zaire. Have taken refuge for awhile with my sisters and near my brother in the subarctic climate of Boston."

Have talked on the phone recently with Dave Shepard, Jim Killian, Bob Dawes, "Pink" Salmon, and Don Cunningham all of whom seemed well and active in M.I.T. affairs. Don reminds us that the 55th is planned for the same location in Chatham. — William Meehan, Acting Secretary, 191 Dorset Rd., Waban, MA 02168

27

We have belated notices of the loss of two of M.I.T.'s illustrious sons. Marshall W. Jennison died September 18, 1979. He was born in May of 1905 in Portland, Maine. Receiving his S.B. with our class, he went on to a Ph.D. in philosophy from M.I.T. in 1932. He taught at M.I.T. from 1925 to 1946 and in 1945 lectured at the Harvard School of Public Health. Professor Jennison retired in June, 1971, as chairman of the Bacteriology Department after 12 years at Syracuse University. His efforts led to the combining of bacteriology, botany, and zoology into a biology department and the construction of its present research building. Dr. Jennison was principal investigator of the Office of Naval Research project on the physiology of wood-rotting fungi from 1948 to 1959. He was a member of the American Association for the Advancement of Science, fellow of the Public Health Association, and a charter fellow of the American Academy of Microbiology.

Francis L. Ford of Fairlawn, N.J., died June 12, 1979. He was a graduate of Boston College and received the S.M. from M.I.T. in 1927 in chemical engineering. He was a process and chemical engineer with Petro Chemical Co. of N.Y.C. until

his retirement in 1967. He was also a consulting engineer for Foster Wheeler Co. and prior to that with M.W. Kellogg Co.

Walter E. Caunt, retired civil engineer for the town of Wellesley, wrote a story published in the *Boston Herald* last November. He took note of the big placard bull that the ATO fraternity boys hoisted to the top of our main dome. Walter reminded us of how "in our day we hoisted a live cow from one of the local dairies. She was put in the service elevator of Walker Memorial and taken up onto the flat roof. At dawn the next morning, there she was on the skyline, overlooking our institution of learning, eating hay which the fellows had provided." Now we know who was persuasive with a cow! Congratulations Walter. — **Joseph C. Burley**, Secretary Pro Tem, 5 Hutchinson St., Milton, MA 02187

28

These notes are being written in mid-January and we have before us all the beautiful greeting cards and notes thoughtfully sent by so many classmates. Our thanks and appreciation to all of you. Our own year-end mailing has been badly delayed and we are still working at it even on this late date!

Velma and Charlie Worthen, after long delays, finally moved into their new home in San Jose, Calif., last September 30. They like it very much. . . . **Lillian and Tom Larson** are settled in their new home at Lake Worth, Fla. Tom's latest report is that he is feeling very well and now playing golf regularly. . . . **Lela and Walter Nock** have also moved and now enjoy the convenience of living at a retirement complex in Westlaco, Texas. The past year was a busy one for them and included a cruise trip to Panama and a hospital trip for Lela. Lela says she has recovered very well. . . . A note from **Fanny and Howard Emerson** in Clearwater, Fla., says they celebrated their 50th wedding anniversary last November 2. Congratulations!

Mary and Max Parshall wrote us a good lively account of the past year at their Montana home. They keep busy with travels, visits to old friends, entertaining guests, gardening, photography and trout fishing (when they can). Except for one long bout with the flu, they report in as otherwise being very well. They were much pleased to have received a greeting card and letter from **Nap LeCroix**. . . . Last summer **Ann and Will Tibbetts** visited their grandson in Germany, their "Austrian son" in Munich, then went on to spend several weeks in the Italian Alps. Once cable car ride took them to a 12,000 foot peak. . . . From **Pam and Rene Simard**: "Nothing much to talk about — health is still O.K. Our last two kids are finally both in University. Time marches on, even for the class babies!" . . . **Gracia and Tom Harvey** celebrated their 50th wedding anniversary last June and family members from everywhere assembled for the occasion. Later in the summer they took a steamboat trip from St. Paul to St. Louis on the famed Delta Queen, then returned home to Indianapolis by Amtrak. They feel fortunate in having some of their family living nearby. . . . **Verna and Carroll Smith** sold their home in Maryland last October and moved to Williamston, Mich. This will bring them nearer to their relatives. As a part of the newly acquired "freedom to go" they expect to spend the month of March in Green Valley, Ariz. . . . **Peggy and George Mangurian** report enthusiastically on their quiet but busy life together in Madison, Conn. Their time is occupied with gardening, golf, swimming, bridge and friends. Last February they spent three weeks in Florida where they had a pleasant luncheon meeting at Fort Lauderdale with **Alice and Vic Decorte** and with **Anne and George Palo**. The Mangurian's older son has just had his second book published: *The Children of the Andes*. The younger son has been honored as "a promising creative architect."

Again, with deep regret, we must report the deaths of three classmates. **Clark F. Merrick** died on October 30, 1979. Clark studied in Course IV and worked professionally as an architect. He leaves his wife, Priscilla, and their sons, David and Jeffrey.

Jean M. Roberts died on October 31, 1979. The information was received from his wife, Bessie. Jean was a graduate student with us in Course VI. For many years following graduation Jean filled important positions in electrical engineering for several prominent industrial companies. In the later years of his career he was Professor of Electrical Engineering at the University of Virginia, Charlottesville, Va.

Donald J. F. Sabin died September 11, 1979. Don graduated from Course XV and had his entire career with New England Telephone Co. His work covered areas in both personnel management and supervision of mechanized accounting. In talking with wife, Alice, we learned that Don had illnesses extending over several years. The Sabins have a daughter, June (Hemphill), and two granddaughters. To each of these classmates' families we extend our heartfelt sympathy. — **Walter J. Smith**, Secretary, 37 Dix St., Winchester, MA 01890

29

Harold C. Pease (Florida) writes, "It was nice to get your birthday greetings from the Class of 1929. I always look forward to receive same. I am sorry, I couldn't make the reunion. It wasn't in the "cards." I would have liked to have seen **Bob Pride** and **Len Peskin** and others. I do get north once in a while to see my family. One grandson is nearly ready for college. I went to England and Ireland for a visit last fall, but have lead a quiet life since. There was no hurricane damage here this year — just a lot of flooding." . . . A note from **Eric Branchi** (Florida) reads, "We were sorry to miss our 50th Reunion: a combination of real estate transactions and the energy crisis dictated that we should stay home. We purchased a house here in June and put our condominium on the market, which proved to be slow all summer; but we have just sold it, which will enable us to move to our new home on Tequests Country Club on January 6. Kind regards to all."

Harry E. Shoemaker, Arcadia, Calif., writes, "I retired a number of years ago as an architect. For some time now, a group of about 20 M.I.T. alumni have been meeting at Caltech once a month, except for three summer months. We always have a noteworthy speaker on various subjects. Next Wednesday, our speaker will be the president of Union Oil Co. on the subject of energy. We also have had speakers from Jet Propulsion Laboratories with slides and literature about the planets. We live in an exciting era. God bless you and all the rest of our classmates."

Frederic Celler regrets his inability to attend our recent 50th reunion. "We were most disappointed," he continues, "as Margery had to have surgery performed on her hand during that period, and I had to attend a directors' meeting in France right after. We will be back to Florida in October, as usual."

Richard K. Oppen writes, "I certainly enjoyed attending our 50th reunion. I also had a delightful four-day weekend in mid-June at Eastham on the Cape. On July 16, I took off for Sabago Lake (Maine) and on August 18, we had a picnic for 30 people at my ten-room house in Walcott, Conn., full of antiques. I had another picnic the same way on August 26 for 31 persons. As you can see, never a dull moment. When September comes, I attend board of directors' meetings for Naugatuck YMCA, Wolcott Historical Society and Wolcott Industrial Development Commission. I also try to think "young" by closely associating with a neighboring family with four youngsters, ranging from age 10 to 16. So it goes."

Two of my classmate friends who send me Christmas greetings include their annual year-end summary of family events, which are very helpful to your Secretary. One is from **George J. Meyers, Jr.** and Barbara, and the other is from **Warren W. Walker** and Elsie. The best thing that happened to the Meyers during 1979 was the arrival of George IV, a grandson born on December 29, 1978, and worst was that George suffered from shingles for four months. Both George and Barbara are active in their church: Barbara is on

the boards of E.C.W., the Episcopal House, Soroptimists, and the Altar Guild of Christ Church; while George teaches confirmation class. They both play tennis regularly. Professionally, George's management consulting work load has been somewhat reduced and he is operating from his home base, while Barbara closed her real estate business and joined another realtor to also carry on from home. George is chairman of the Real Estate Board's Legislative Committee and a member of the State Committee as well. George has also taken up oil and acrylic painting through courses at Alvernia College and the Wildlife Summit. While George and Barbara attended our 50th reunion, Barbara had her 45th Radcliffe reunion in Cambridge immediately after ours.

After a happy family Christmas, the Walkers ushered in the New Year with friends and joined the Michelsens (son-in-law and family) to celebrate Warren's 72nd birthday on January 15. In spite of this milestone, Warren plans to continue working full-time with enthusiasm and dedication at Graphite (his metal graphiting business) according to his philosophy that a person should overlook age; he will continue to work as long as he is productive and the work is pleasant. Warren's son-in-law, John Michelsen has been associated with Graphite for eight years as vice president and plant manager. His son Eben recently joined Graphite after working with Citibank (N.Y.) for five years as vice president. In spite of Warren's dedication to Graphite, he takes time off for pleasure trips. In March, Warren and Elsie flew to Texas to celebrate their daughter's birthday. In April they attended an electrical manufacturers meeting in Ponte Verde, Fla., going on to Baltimore to spend Easter with their daughter Polly. One of Warren's side achievements has been his revival of the A.A.I.M. (Yonker's Division) as its executive director. Also he has been a contributor to their periodical on industrial management and manufacturing.

I regret to announce the death of two of our members: **William C. Whiting** on July 20, 1979; and **Bion H. Francis** on October 15, 1979. Bill had been associated with the New England Fire Insurance Rating Association as an engineer for 42 years until his retirement ten years ago, continuing his association as a consultant until his death. He was a member of the National Board of Fire Engineers, National Safety and Industrial Board and Flammable Liquids Commission. He was a resident of Hanover, Mass., for 50 years. He was a member of the town Scout Commission, both for Boy Scouts and Girl Scouts, a Scoutmaster for Troop One, and a photographer for the Garden Club. He also was involved in the restoration of the Old Ship Church in Hingham. He was a member of the Audubon Society, member of the Manomet Bird Center in Plymouth and consultant for the South Shore Natural Science Center in Norwell. He is survived by his wife, Valerie, a son, and a daughter. . . . **Bion** was a retired manager of Colt Industries of Connecticut. He was a life member of the American Management Association and past president of the Charlesbank Club of Boston. He has published several books on insurance and management. He is survived by his wife Helen, three sons and four grandchildren. — **Karnig S. Dinjian**, Secretary, P.O. Box 83, Arlington, MA 02174

30

50th Reunion

As many of you know, the disaster area identified as the U.S. Postal Service can sometimes make life quite complicated. For reasons that cannot be detailed, I have received no mail at all from M.I.T. for the last month.

Since this issue of the *Review* is likely to be the last that will be published in time to affect your reunion decisions, I have decided to recapitulate some of the information from prior issues, as well as to include additional information obtained by telephone in the last few days. Reunion activities are scheduled to begin at Chatham Bars Inn on Cape Cod on Sunday, June 1, 1980. It is anticipated that most classmates will arrive during the course of the afternoon, perhaps early enough for

9 holes of golf or a set or two of tennis before supper. A buffet supper will be served that night and followed by a class meeting including brief reports by the officers, after which movies of prior reunions will be shown. The banquet will be held Monday evening and our speaker will be Phillip Morrison, an Institute Professor and one of the world's outstanding astrophysicists. The usual clambake is scheduled for Tuesday afternoon. Daytime activities will include sports and sight-seeing.

On Wednesday we are to move to Cambridge for various on-campus activities. Tentatively "Yicka" Herbert, who has an exceptionally fine coin collection, will give a talk about his collection on Wednesday evening. Thursday evening will be M.I.T. night at the Pops. Friday, June 6, will be Technology Day at which all returning alumni will convene to hear a variety of reports, announcements, etc. It is at this event that the amount of our 50-year gift to the Institute will be revealed. If you have not already done so, I suggest that it would be appropriate for those of you who are in a position to do so to make a fairly substantial contribution on this 50th anniversary of your graduation from M.I.T.

As most of you know, it has been traditional for members of the 50 year class to wear cardinal red jackets on Technology Day. I believe that George plans to cover this subject in his second reunion mailing and will include order forms. In any event, while no classmate should feel obligated to purchase such a jacket, I understand they will be available for those who would like to have them for about \$75. If you have any last minute questions, it might be well to address them to George at 230 Waltham Street, Lexington, MA 02173, telephone (617) 862-1194.

Thanks to the cooperation of Ed Worden, who is secretary of the Class of '31, we have at hand several notices that were mis-sent to him concerning deaths of a number of our classmates, specifically, **John S. Riley** of Chevy Chase, Md., on September 9, 1976; **Edward J. Rhodes** of Glendora, Calif., on March 13, 1978; **James W. Rice** of Silver Spring, Md., on September 13, 1979; **Joseph W. Landry** of Moultonboro, N.H., and Hyattsville, Md., on October 15, 1979; and **St. George Tucker Arnold** of Oak Ridge, Tenn., on December 1, 1979. Unfortunately, little information is available about these classmates, except for Tucker Arnold whose death was the subject of both a news article and an editorial in *The Oak Ridger*. Tucker took his undergraduate work at Randolph-Macon where he majored in mathematics. After teaching at Ashland H.S. for a year he came to M.I.T. and received S.B. and S.M. degrees in electrical engineering. During the post-W.W. II years he was employed by the AEC in Oak Ridge. During his years in Oak Ridge he engaged extensively in public service activities including work for disabled children in the March of Dimes program and as a founding member of a rehabilitation center, directorship in the local music association and in the Uplands Retirement Home and vestryman of the Oak Ridge Episcopal Church. . . . My records show that **James Rice** was a regular army officer from 1917 to 1946 and acquired an S.M. from M.I.T. during this period. After retiring as a colonel in 1946 he became interested in the preservation of old and historically significant textile materials and did consulting work in that field. . . . Remember June 1 at Chatham Bars! . . . — **Gordon K. Lister**, Secretary, 530 Fifth Ave., New York, NY 10036

31

A note from **John Minami** in Japan wants to know if he will be hearing about our 50th Reunion in the months ahead. (John, you will be reading about it soon in the Class Notes.) He also says that he is enjoying retirement, reading and exercising to keep physically fit. . . . Hope and **Randy Binner's** Christmas card said they were spending the holiday in Minneapolis. . . . It was a pleasure to hear that **Bert** and **Jack Lane** are doing well. Jack is still active with his work for Total C.F.R. in France, visiting once a year, and involvement with

NLGI, NPRA, SAE, ASTM and IOCA. During the past year, their trips have taken them to Florida, Palm Springs, San Antonio, Detroit, Chicago, and Canada. Jack and Bert celebrated their 50th wedding anniversary last August. Their sons, Whitney and Bradford, hosted a surprise party and guests came from Massachusetts, Rhode Island, Connecticut, and the New York area. . . . **Claude Machen** has reported that his dues solicitation for the 50th Reunion was quite fruitful, so our Reunion Committee will have a solid foundation. . . . **Bill Stellrecht** reports from Stuttgart that he is still going fairly strong and promises a lengthy report on his activities in the very near future. . . . **Fred Elser** (KH6CZ) and I (AA4AS) have been keeping a regular schedule on Sundays by ham radio from Honolulu to Florida at 0200 G.M.T. on about 14,008 KHz and are hoping that **Cliff Harvey** (W1RF) and other hams from our class will join us. — **Edwin S. Worden**, Secretary, P.O. Box 1241, Mount Dora, FL 32757; **John R. Swanton**, Assistant Secretary, 27 George St., Newton, MA 02158; **Ben W. Steverman**, Assistant Secretary, 3 Pawtucket Rd., Plymouth, MA 02360

32

Frances T. Gowen writes that he retired from Raytheon in April, 1971, after 30 years. He keeps busy with general contracting — carpentry, painting, and interior decorating. During a trip across the U.S. last year he located a son of **Charles W. Isselhardt** (XV) and learned that Charles died in April of 1978. The Gowens have made several European trips visiting friends in Italy and England. This past year they drove across Canada to Vancouver and returned across the northern U.S. . . . **Royal B. Jackman** has been appointed to the Planning Commission of the Architectural Board of Review, city of Ojai, Calif.

We have decided to run another class of 1932 golf tournament even though only six of us participated in 1979. If twelve enter in 1980 we will award some suitable prizes. Here are the simple rules: (1) During July play a round of golf on any regulation golf course; (2) Mail your score card to me and tell me your handicap; and (3) Results must reach me by August 15. Those of us who are playing golf make a note now to participate. Please don't forget.

We have received the sad news that **Steven A. Coons** died on August 19, 1979, in Boulder, Col. He was a professor at M.I.T. for several years. He resigned in 1966 to join the faculty at Syracuse University. Professor Coons was a pioneer in the field of computer-aided design. His skill as a designer and geometrician were combined in a technique he developed for manipulating space figures that has become known as "Coon's surfaces" or "Coon's patches." Most recently he was professor emeritus in the University Computing Center at the University of Colorado at Boulder. Professor Coons is survived by his wife, who lives in Boulder. — **Melvin Castelman**, Secretary, 163 Beach Bluff Ave., Swampscott, MA 01907

33

Headlines this time around are for the thoughtful friends who sent Leona and me Christmas cards, knowing that it is impossible for us to send cards to 400-odd classmates. Starting at the top, **Betty** and **Henry Kiley** hope that we are enjoying the winter in Florida. They will spend the holidays with their three children. Both admit that they are quite well. **Katherine** and **Carl Swanson** come through with their usual seasons greetings and Carl makes a short report of a meeting at the Union League Club of New York, where funding matters were discussed, and which was attended by **George Henning**, **Dayton Clewell**, and Carl himself from our class. He also listed several of my personal friends from other classes, including especially **Gordon Lister**, secretary of the class of 1930. **Eileen** and **Dick Smith** of Illinois and **Key Biscayne**, Fla., where they are, do enjoy the climate and the leisure for personal activities. It appears that they also summer part time in Minnesota.

Golly, it's a tough life.

Always faithful are **Charalee** and **Dick Fosset**, who send us best wishes and a short report on their "best hike this year" in the Wind River Range in Wyoming. I had to look up that one to discover that it is in southwest central Wyoming. It is also famous for one more item — it is bordered on the west by the highest point in the state: 13,000-plus feet high. That's really tough hiking, friends. **Louise** and **Ellery Clark** have done some ship traveling. Last winter they took the last leg of the *Q.E. II* round-the-world cruise from Louisiana to New York City, and this year they are planning a 36-day trip to the South Seas with emphasis on New Zealand. We must assume that this trip is by air, as the ship would use up 80-odd days. Sounds great.

One of my oldest friends, **Neil Hopkins**, sends a snow scene card and a big note, too long by far to quote here. But, Hop is, as always, thorough: He bikes, threatens tennis, puts on the roof of a house addition in the summer, and insulates the siding in the winter. He even brags about it. Hop says that Ruth is faring quite well in her eternal struggle with Parkinson's disease, and, though in a wheelchair, manages to attend quite a few social occasions. Leona remarked, "I understood that this guy was a Tau Beta Pi. But, reading this note, he is more like Phi Beta Kappa."

Ellie and **Ralph Cross** send us their very best wishes for the season. **Westy's** card wishes Leona and I the best for the holidays and the new year.

We have a lovely card from Ann and **Merry (Meredith) Morgan**. Though the text is not too legible, I gather that the Morgans attended the 45th, and they have an Angus breeder near by. Well, I was an Angus breeder for 30 years, but got out 10 years ago, so the chances are that I do not know the man. The most novel, interesting, and last card to arrive is that of **Lucy** and **George Henning**. The card is their usual montage of family photos, large and small, assembled on one page. I have never asked, but would guess that Lucy selects the photos. **Jack Andrews'** letter this time is, as always, newsy. Big event of the year was the 50th wedding anniversary of **Jermain's** parents, with the whole family attending at Lake Placid. A real personal touch finds Jack and Jermain remembering that 1979 was Leona and my 56th wedding anniversary. Thanks, folks. **Doris** and **Len Julian** report that their big news is an 11-month-old grandson. Maybe he is the first, and the lurid details support this assumption. The Julians plan a two-to-three-week stay in Palm Beach in early January. They both attended Len's 50th reunion at Brockton High School, where 175 people showed up for a great time.

The **Werner Bachlis** come through with "no news" but lots of family gossip. Jeannette is "hooked" on hooked rugs, with one real good one on the credit side. Werner keeps busy at yard work, but does it all manually, for health benefits, though there is a power saw and motor lawn mower ready when he peters out. He is still a member of the Appalachian Mountain Club, and, by definition, does a lot of hiking. Werner put in one week with G.E. last year, but was told that there would be more this year. With an occasional minor discomfort, both of these folks are in good health, which is great for a couple of old timers. So much for seasonal cards and messages. Leona and I enjoyed all of them, and only regret that we can't send cards and greetings to all you readers.

We have a fine letter from our class president, **Ellis Littmann**, who gives us a picture of how a busy man spends his time. He and Roz expected to spend the holidays in Colorado with children and grandchildren, and later they will go to Hawaii on a business-pleasure trip. They then intend to get to Florida for a more extended visit. Apparently Ellis has not heard of Leona's rather long illness — over three months to be exact. The story is too complicated for this space, except to say that her troubles have been intestinal. At first she was reluctant to undergo any treatment, which turned out to be shortsighted. She lost a lot of weight, but only recently she has started to gain a bit. She is quite cheerful, and quite as happy as may be expected under these poor conditions.

So, we did not go to Florida this winter, but hope to next year. Ellis is in hopes of having a class get-together this year in Florida if it can be arranged. I suggested to him that the great majority of our classmates in Florida live in the rather large area of Sarasota-St. Pete-Tampa-Orlando. Draw a line as above, and 85 percent of the Florida contingent live within an hour's drive of it. However, when you read this, the event will be history.

Last but far from least is a fine letter from **Bill Klee**, who is now a full-time resident of Hilton Head, S.C. after spending most of his life in and near Warren, Ohio. The Klees built a winter home on Hilton Head some time ago, but when we looked it up some time ago we found no one at home. After moving to Hilton Head, Bill offered his services to M.I.T. as educational counselor, which has been his forte for many years. As a result, the Institute made arrangements for Ms. Dany Siler of the Placement Office to visit Savannah. Bill says that this was the first M.I.T. meeting in Savannah ever. They had a dinner, attended by alumni and prospects, and then the guidance counselors met for a fine breakfast get-together. These meetings were well attended, and it turns out that there are 19 alumni on Hilton Head and 30 more within a 50-mile radius. Incidentally, 7 of these alumni joined the Educational Council. To quote Bill a bit further, "Now that we are here permanently, we would be delighted to see anyone who is in the area. We both enjoy and are grateful for our continued good health."

I have a rather unique story from the Alumni Fund Planning Office about Dr. **Hugh Darden**. This came as a copy of his letter to our own **Bill Harper**. I quote: "The arrangement you suggest for funding a contribution to the William Barton Rogers pooled income fund through cash in the form of principal and interest on certificates of deposit seems most appropriate. . . . It might be best to proceed with your gift during 1983 when, as I understand it, you will have a maturing certificate which, together with interest, will be sufficient to make the required initial gift to the pool." I have included this quote without Bill Harper's permission because it is an example of clear, honest thinking.

That's it for this time around. Just write me a bit often, and yours most sincerely, — **Warren Henderson**, Secretary, Fort Rock Farm, Drawer H, Exeter, NH 03833

34

Sorry about the missing notes from the February issue. It was a combination of procrastination and then getting caught in the Christmas rush. But here they are, with a few additions.

The Alumni Fund notes are heavily weighted with summer traveling news but one, non-travel item is especially pleasant to pass on. I have previously reported on some of the accomplishments of **Elizabeth M. G. MacGill** of Toronto and the honors that have come to her. She notes the latest "scalp added to her belt" (my words, not hers) — "Received the major award — the Professional Engineer's Gold Medal from the Association of Professional Engineers of Ontario — for outstanding achievement in the practice of engineering in the service of her country in peace and war." It is indeed nice to have as a classmate someone who has received the recognition that she has.

Now for some of the travelers. **Mal Stevens** writes "This was our year to travel. In May we spent three weeks in Scotland and a bit in England prior to attending our AFS "daughter's" wedding in Belgium. Then we really tossed caution to the winds and took an unplanned trip to the Galapagos. It was much more than a trip — it was a once-in-a-lifetime experience. Fantastic!"

... **Gil Loring** notes "Thelma and I enjoyed a three-week tour of Yugoslavia in August. A fourth grandchild, and first granddaughter, Carrie Marie Johnson, was born Oct. 19 to our daughter in Denver, Colo." ... **Jim Eder** didn't, as I recall, mention his trip to Russia at reunion, but writes that he and Mary took their second trip to that country in

May and then went to China in September. He tried to look up **Y. T. Chin** in Hong Kong but found he was in this country visiting his many children here.

Our other China visitor was **George Bull** — you may remember that on his first try they got as far as Hong Kong and then Mary Elizabeth became so ill that they had to return. This time things were better and George says "Mary Elizabeth and I, after spending a few days in San Francisco, took off for China. This time we made it. With a mixture of trains and air travel, we visited Canton, Hangchow (with its beautiful West Lake), Soochow (located on the famous 1,000 mile Grand Canal), Shanghai, and Nanking, with old tombs and the bridge over the Yangtze river that any nation could be proud of. Of course, Peking was the climax, with the Temple of Heaven (I think one of the most beautiful buildings ever built). We were impressed by the Summer Palace and the Forbidden City. Had a perfect day to visit and walk on the Great Wall. Unfortunately, of the thirteen Ming Emperor tombs, only one is open to visitors. But that is as impressive as any other great man-made underground work I have ever seen." George apologizes for not writing a letter but says he brought back a bug that left him rather weak for a while. It sounds as though anyone who has ideas of visiting China could do worse than pick Jim's or George's brains about their planning.

One note from a stay-at-home came from **Aaron Redcay**. He writes "for many years I have read the Class Notes (Thank you, Aaron) in the *Review* and from time to time I have reminisced with fellow classmates. Several months ago I retired and am working into activities to fulfill my life. My daughter has asked me to join a business venture with her." Maybe I should repeat my warning — look out for those retirement activities, they can make you wish for the simple life of working.

The final item concerns a clipping **Larry Stein** sent me about **Paul Wing** and the forty years he has devoted to the hobby of stereo photography. Paul has a tremendous collection of old stereo viewers, cameras, and cards, but the creative aspect of his interest is the continual work he does with both regular and special set-ups, sometimes varying the "inter-ocular" distance of his cameras. I've seen some of the spectacular 3-D effects that he has obtained, and they are really something.

Among the new items, unfortunately, is the notice of the death of **Theodore Pearlman** on November 7, 1979. Along with the information about his death was a donation in his memory for our 50th year fund. Once more, for the class, I would extend our sympathy to his widow Doris and appreciation for the memorial.

Another Alumni Fund note appeared — this one from **Tom La Cava** who says "Still trying to retire gracefully on Cape Cod." Tom is a faithful member of the M.I.T. Club of Cape Cod and I usually see him at our meetings.

More from **Larry Stein**. He writes that the M.I.T. Class of '34 ham radio net meets Sundays at 8:45 a.m., presently on 3.600 mKz and then moves to 3.175 mKz at 8:55 a.m. The members are **Ray Jewett**, WA1TJC; **Tom Burton**, KA1DHM, and himself, W1BIY. This is a code (cw) net. They are subject to change without notice and if any other ham classmates want to join or try another time or frequency, they should get in touch with Larry at 374 East Street, Hingham, Mass. 02043.

Finally, on a personal note, I started the New Year off in fine fashion by landing in the hospital on Jan. 2 with another heart attack. (No — it was not the result on a riotous New Year's week-end!) Apparently it was not too severe as I was back home by Jan. 12 and it looks as though I'll be driving again after January 29. I'm feeling fine, but it is obvious that I will have to disengage myself from some of the town activities I've been busy with. We had to scratch a Caribbean cruise planned for March but happily the doctor sees no reason why we can't go ahead with our plans to travel to England in May. — **Robert M. Franklin**, Secretary, P.O. Box 1147, (620 Satucket Rd.), Brewster, MA 02631; **George G. Bull**, Assistant Secretary, 4610 N. Park Ave., Apt. 711 Chevy Chase, MD 20015

35

45th Reunion

I am happy to be able to pass along to you a letter I received from **Sid Grazi** as follows: "Ann and I have been on the go since August 12 when we left Denver for a trip through Grand Tetons, Yellowstone, Glacier National Park, Banff, Lake Louise, Jasper, and Vancouver, B.C. We then spent eight days on the Sun Princess for a cruise of the Alaska Inland Passage including Glacier Bay. Upon our return to Vancouver we spent a few days there and in Victoria, and then headed down the coast to our little 'adobe hut' at La Costa. As you may know, I called **Gerry Rich** and **Mort Rosenbaum** in an attempt to arrange a three-way match or just a head-to-head match with each, but Gerry was tied up at the time I went through San Jose. So, Mort and I played a match during the week I was in the San Diego area."

"We returned to Denver long enough to do our laundry and took off for our third trip to Israel and our first to Egypt. Although Egypt is impoverished, dirty, and disorganized (especially for tourists), we were amazed and impressed with the remains of a culture which appears to have surpassed ours in so many ways — from 5,000 to 7,000 years ago. We spent six days on the Sheraton Floating Hotel cruising the Nile. All in all, despite many inconveniences, delays and frustrations with 'guaranteed' reservations, and needing an all-day soaking in a steam bath to get the dirt out of our pores, we enjoyed Egypt and its Sphinx."

"We went on to Athens for a few days and then to New York for a week and back to Denver where we again took enough time to do laundry. We then took advantage of a very special low-fare round trip to Miami for two weeks. After another short stay at Denver we headed down here (Carlsbad, Calif.) to our winter hide-a-way. We expect to see **Anni** and **Irving Banquer**, **Lorraine** and **Mort Rosenbaum** and **Edythe** and **Ham Dow**." I don't know about you but I feel out of breath just typing this account. I wish I could get out there and join you for a golf foursome, but I do not see the opportunity in the immediate future.

After spending four days in Dallas with Doreen at the annual Mary Kay Cosmetics seminar attended by 8,000 beautiful women and a sprinkling of husbands from all over the U.S., Canada, and Australia; and seeing all the honors heaped on her for her work (including diamonds and a pink Cadillac), I have decided to concentrate most of my efforts in being her business manager. I am just following in the footsteps of hundreds of other husbands whose incomes have been outstripped by their wives' Mary Kay incomes. If your wife is foot-loose and fancy-free, have her get in touch with Doreen. It's a fantastic opportunity and as long as your wife (or daughter) is over 18 she's eligible. I also plan to keep my hand in by taking on selected consulting jobs.

Sign up now for our 45th Reunion, June 5th to 8th. — **Allen Q. Mowatt**, Secretary, 61 Beaumont Ave., Newtonville, MA 02160

36

The Alumni Office has informed me of the death of **M. Robert Saslaw** on November 22, 1979. He is listed as living in Poughkeepsie, N.Y. (15 Croft Road, 12603). At this time I have no further information. . . . I regret to report the death on January 20 of **Charles H. Betts** of Scotia, N.Y. He is survived by his wife Virginia who resides at 1573 Belmont Ave. More information will follow in the next class notes.

On a more pleasant note — by the time you read this, class president **Tony Hill** and his bride Dottie will be living in Laguna Hills, Calif., at 5302 Cantante (92653). . . . The forty-fifth reunion committee has analyzed all our responses and made plans accordingly. The reunion will start on Tuesday, June 2, 1981 somewhere on Cape Cod. After luncheon on Thursday we will repair to M.I.T. for the buffet supper and Pops concert. Friday, after the Alumni Day activities, we will have a class meeting, cocktail party, and dinner to wind up the festivities. I like the idea that those who are unable

to join us on the Cape will be able to participate in a major event in Cambridge.

A year or so ago I noted that the *Journal of Optimization Theory and Applications* in January 1979 was publishing an issue in honor of **Rufus Isaacs**, professor emeritus at Johns Hopkins University. My reaction upon receiving a copy was to realize how much better it is to be honored while you are around to enjoy it, rather than posthumously. Rufus's own contribution "On Applied Mathematics" is a delight. The abstract states, "This paper covers some aspects, problems, and episodes of applied mathematics intended to be enjoyable, instructive, and advisory to the young." Well, I am not very young but . . . I recommend it to you. — **Alice H. Kimball**, Secretary, P. O. Box 31, West Hartland, CT 06091

37

Norm Birch reports from Shaw Rd., So. Carver, Mass. the birth of grandson, David Alan Birch, offspring of son Alan and Cathy on March 9th, and of being fortunate to have seen him five times during his first nine months of life. Norm and his wife Elvie went to Corning in March and for Thanksgiving. Son Eric's family were in So. Carver for the month of August, "staying in their own cottage next door and it was great fun to have them around for a much longer time than usual." Norm and Elvie were with them in England for Christmas, but could not be there when their third child is expected in late January. "Having two boys, they'd like a girl but sex doesn't really matter so long as the baby is healthy." Norm worked in Portugal for two weeks in April 1979 and again in November. Spent the first two months of 1979 in Florida, and in July enjoyed three days at Moosehead Lake, Maine, then a delightful week of school at University of Maine at Fort Kent, followed by a week's tour of New Brunswick.

Rutherford (Bob) Harris, 36 Orchard Lane, Wayland, MA 01778 retired from Arkwright-Boston Insurance Co. on December 1, 1978, as vice president, planning. He plans to remain in Wayland. His daughter Sally is mother of two boys (ages 3 and 7) and lives nearby. Son Ford is married and lives in Santa Monica, Calif. Bob is keeping busy with several volunteer assignments as chairman, Boston area, for personal Alumni Fund solicitations, involvement with church administration, and on the town of Wayland's Personnel Board.

Richard (Dick) Lamphere is retired and lives at Rt. 4, Kingston, Tenn. 37763. He is still a member of the American Association for the Advancement of Science and the Federation of American Scientists. His traveling has been mostly in the U.S. and Canada. His special interests and hobbies are hunting, shark fighting, antique automobiles, electrical gadgets and investments. He has three children and reports his wife's main interest is "Taxes."

It is with regret that we report a letter dated November 10, 1979 from Doufe Dzong (Albisstrasse 3, 5430 Wettivven, Switzerland), son of **Long Shuen Dzong**, reporting death of his father in September 1978.

It is also with regret that we print here **Barbara Claffee's** note of December 5, 1979. "This note is long overdue. Regretfully I must inform you **Fred** died of an acute coronary occlusion October 20, 1978. Fred retired February 28, 1978 from the European administration division of E.I. DuPont de Nemours, Geneva, Switzerland. We returned to the States May 1, 1978, with great enthusiasm for his retirement. Sadly he was deprived of his happy expectations. The details of our personal affairs so totally inundated me my correspondence has been very neglected."

Barbara's address is 36-A Heritage Circle Dr., Southbury, CT 06488. — **Lester Klashman**, Assistant Secretary, 198 Maple St., Malden, MA 02148; **Robert H. Thorson**, Secretary, 506 Riverside Ave., Medford, MA 02155.

38

By the time this reaches you, you will have received notice of our class dinner to be held on Technology Day, June 6, in the ballroom of the Wayside Inn at Sudbury. For those of you who haven't been there, this is the inn about which Longtellow wrote his tales. In addition to good food, drink, and the opportunity of renewing 1938 friendship, those of you who attend can roam the grounds and visit the rooms of the inn which are on display.

The last time I saw **Horace Homer**, he, like me, had retired to Cape Cod. Alas, not so. Despite his retirement as a senior scientist from GTE Sylvania, Danvers, Horace was installed as prexy of the Association for Finishing Processes of the Society of Manufacturing Engineers.

Lloyd Bergeson is doing his bit to conserve energy. He is president of a newly formed company, Wind Ship Corp., which is presently researching sailing ship design with an eye to developing commercially profitable routes and cargoes which might be carried in modern sailing ships. . . . **Russ Colle** invites any of you to visit him in Rio de Janeiro, where he will be working all this year on an operations research project in support of the Brazilian Navy.

Bill Burrall, who retired from Rockwell International in 1972, has just retired from being a mental health counsellor. He is now continuing his interest in nature and wilderness, having just finished training as a docent-trail guide at his local Nature Center. . . . **Arch Copeland** is still playing golf and living at Heber Springs, Ark., with time off to Lansing to help his second son and wife with a new baby. — **Armand L. Bruneau, Jr.**, Secretary, 663 Riverview Dr., Chatham, MA 02633

39

Phil Bush served for years as group vice president of Kaiser Engineers where he made major contributions to the steel and nuclear energy divisions. After retiring, Phil and Marge made interesting trips by boat down the Danube and by narrow-gauge railway through the Austrian Tyrols. Their travels brought them to La Jolla recently where we enjoyed reminiscences one afternoon as we shared the peaceful and beautiful therapy of our ocean view. Phil and Marge continue to reside, between trips, at Orinda, Calif.

Manning Morrill accepted a new assignment as president of Pelex, Inc., which headquarters at Milford, Mass.

Solomon Baker was especially honored by the president and 150 employees on his 40th anniversary with Rogers Corp., where he serves as vice president of the Industrial Materials Division. Sol has been active in local and national Jewish organizations and he founded Temple Beth Israel in Danielson, Conn., in 1949. — **Hal Seykota**, Secretary, 1421 Calle Altura, La Jolla, CA 92037

40

40th Reunion

The Gift of Giving! **Norman R. Klivans**, 40th Reunion gift chairman, writes: "Whatever you've been sharing with M.I.T., large or small, please think about a more generous pledge for this major time in our lives. And, if there are some unique or special considerations about your gift which require some clarification, please call me at the office (216-932-7119) or at home (216-247-5440) or call Nancy Russell, Associate Director of the Alumni Fund (617-253-8215)."

Top Brass for the 40th: president, **N. Bruce Duffett**; vice president, **Norman R. Klivans** and **H. Garrett Wright**; treasurer, **Edgar L. Bernard**; reunion book, **James L. Baird**; reunion weekend, **John L. Danforth**; class agent, **Phelps A. Walker**; and class estate secretary, **Thomas F. Creamer**.

Half-Mast: **Vladimir Hwochinsky** died last October 11 in Buffalo, N.Y., and is survived by his wife, Anne. **Edward A. Colson** of Hollis, N.H., died November 18.

It Pours: **W. Kenneth Davis**, vice president of

Bechtel Power Corp. and vice president of the National Academy of Engineering, adds to his many interests: membership on the board of directors of the American Society for Testing and Materials and the vice presidency of the American Institute of Chemical Engineers.

Freedom of the Press: **Jim Baird**, **Maureen Feldman**, and **Sally Bittenbender** guarantee your questionnaire will be "unadorned, uncorrected and uncensored" and included in the 40th Reunion book if you send it to them at 25 Oxford St., Winchester, MA 01890. Send pictures, too. — **Frank A. Yett**, Secretary, 1405 Ptarmigan Dr., Walnut Creek, CA 94595

41

Greetings from Wellesley: In case you have missed several issues of the class of '41 Notes it's due to your secretary's moving from the "city of champions" (Pittsburgh, that is) to Wellesley, Mass. I retired early from U.S. Steel and am now vice president of Koch Development with offices at 888 Worcester Street, Wellesley.

Another Move: **Walter Threadgill II** has moved back from Rust Engineering to Barnard and Burk, Inc., a subsidiary of Aerojet-General, in Baton Rouge. Walter is interested in news of his roommate, Dirk Van Dongen.

In the News: **Ken Roe** is in the news again. As president of U.S. Engineers Joint Council he welcomed the director of the Pan American Federation of Engineering Applications, which represents 22 western hemisphere countries. Ken also received the Edwin F. Church Medal of the A.S.M.E. on December 5. The award was for "his eminent service in increasing the value, importance, and attractiveness of mechanical engineering education and his outstanding leadership in professional society activities."

Tragic Accident: **Saul Gifford**, who was president and chairman of the board of Gifford Instrument Laboratory died in a plane accident with his wife Diane and Mrs. Gifford's daughter by a previous marriage. Saul was the pilot. Officials said the Cessna Skymaster apparently tried to land at Bennington Airport twice, then crashed into a slight valley between two peaks on the northeast slope of Bald Mountain about four miles north of Bennington. Search efforts were hampered by foggy weather and by another plane crash in the area, a Civil Air Patrol spokesperson said.

I generally end by saying "keep the news coming," but not news like the last item. — **Henry Avery**, Secretary, U.S.S. Chemicals, 2863-600 Grant St., Pittsburgh, PA 15230

42

Carl Jealous writes that he was promoted to manager of process engineering, minerals technology, Metals Division of Union Carbide, last April! Our congratulations are quite tardy but sincere. Carl is primarily concerned with tungsten, uranium, vanadium, manganese, and asbestos ore treatment into industrial products. The Jealous' have three grandchildren; two in Detroit and one in Boonton, N.J.

Practically no news this month, so I'll have to do a "puff-piece" on me. Was elected a vice chairman of the board of trustees of the Union of American Hebrew Congregations which is the federation of about 752 Reform Jewish congregations in the United States and Canada.

Two obits this month: **Leon Baghdoyan** died in Wolfeboro, N.H. After graduating with our class, he served in the Navy during World War II, retiring as a Lieutenant Commander. Leon's professional career was with Lincoln Laboratory so he really spent his life at M.I.T. . . . **Dick Owen** passed away in Rumsen, N.J., in April of 1979, and we only received word of his death recently. He graduated with us from the naval architecture course. We extend our sincerest sympathies to both of the families.

If someone doesn't send some class news in soon, I'm going to have to get out one of my mail

44

At this time of year many of us in New England appreciate the occasional warm day which signals the coming of spring. From their sunny locations in the garden, crocuses are making an upward push to greet us; and the swollen buds on the flowering trees appear to be waiting for the assured period of non-freezing weather. Luxury is having the time, and money, to follow spring on its northward path.

Last fall, **Palmer Derby**, who is vice president and director of new business analysis for Raytheon company in Lexington, ran the Equipment and Appliance Division for the 1979 campaign of the United Way of Massachusetts Bay.

Arturo M. Morales-Dominguez wrote a note on the flap of the Alumni Fund envelope, asking that we "keep the drums rolling for our reunion in Mexico in 1981." This will take place during the annual M.I.T. Fiesta in Mexico the latter part of March 1981. **Burt Bromfield**, **Paul Heilman**, **Al Hildebrandt**, **John Hoopes, Jr.**, **Sam Lamport**, **John Taft**, and **George Ziegler** were listed as planning to attend the 1980 Mexico trip, March 20-25th.

Several people from the Boston area are planning to attend the long Virginia weekend at the Tides Inn, May 15-18, 1980. See our February class notes for particulars regarding reservations.

It is with a heavy heart that I report the loss on Dec. 31, 1979, of my co-secretary **Newton Augusto Teixeira**. (An autopsy revealed that the heart attack he suffered last July was much more severe than had been diagnosed.) Because of inadvertent omissions from the "official" obituary, plus additional cuts by the funeral director and several newspapers, I ask your indulgence in allowing me to use these notes for an obituary of a great person. Newton was a native of New Bedford, Mass., and won a scholarship to M.I.T. upon graduation from New Bedford High School in 1940. During World War II he was a first lieutenant with the Signal Corps Training School in New Guinea and the Philippines. After he received the S.B. degree in E.E. from M.I.T. in September 1947, he taught and did research in medical instrumentation in the Biology Department. In 1949 he joined Fabric Research Laboratories where he was involved in the development of textile instruments as well as conducting research on the dynamics of fabric structure and on electrostatic properties of polymeric materials. His published papers of this period are still being quoted, as they were last August at a N.A.T.O. conference in Greece.

Also, in 1949, he founded, with '44 classmates **Lou Demarkles** and **Frank Chin**, Associated Engineering Corporation of Boston and served as a director and vice president for 20 years. He was the principle designer and received a patent for the Addaplug Connector made and marketed by the company.

In 1955 he joined RCA as a systems engineer with the Analog Computer Group. In 1959 he started his career in project program management. He developed and ran one of the first complete PERT operations group for a major satellite program. In 1963 he began his career in the field of automatic test equipment and led several programs on its use and adaptations, with the last nine years being concentrated in applications to automotive equipment. For many years he taught RCA courses in the management use of PERT and in program management.

Newton was a member of the American Management Association, Project Management Institute, A.A.A.S., I.E.E.E., and was listed in American Men of Science. He was a past Chairman of the Boston Chapter of the I.E.E.E. Professional Group on Engineering Management. Since 1973 he had been a member of the Administrative Committee of the Engineering Management Society and was its current first vice president. He was the author of numerous technical papers in the fields of textile research, automatic test equipment, and

engineering management.

He was a member of the M.I.T. Club of Boston, M.I.T. Alumni Council, and was a Secretary of the Class of 1944. He was a member of the Tuesday Club of Newton; Wamsutta Lodge, A.F. and A.M., New Bedford; Lodge Council Chapter, Valley of Lowell; Consistory, Valley of Boston; Aleppo Temple; and honorary life member of Cyprus Temple. For many years he was active in the Norumbega Council, B.S.A., serving as a committee member and IR to Troop 307 and Explorer Post 507.

Newton was moderator of the First Unitarian Society in Newton, where he had been a member for more than 20 years. He had served on most of the committees of the church; as a trustee and chairman of its board; and devoted most of these years to the religious education program of the Society. For the past five years he had conducted and coordinated the summer fellowship program, the Christ Eve services, and Sunday services whenever called.

He is survived by his stepmother Virginia Teixeira; his wife, the former Melissa Barker Wood; a son, Thomas J. of Stow (Mass.); and two daughters, Eve M. DeSouza of North Conway (N.H.) and Amy B. Mitchell of East Harwich (Mass.).

Copies of the memorial service for him, together with the sermon given the following Sunday on his interpretation of the Unitarian Universalist thought, and Newton's sermons and talks will be printed and bound together. This should be available later this year.

For the moment, I will be continuing as Class Secretary with occasional guest secretaries as requested by our president **Norman Sebell**. — **Melissa Teixeira**, Secretary, 92 Webster Park, West Newton, MA 02165

45

"Save the dates — June 5-8, 1980 — for Tech Night at the Pops, Technology Day, and our own reunion events." — **A.V.W. (Clinton H. Springer)**, Secretary, P.O. Box 288, New Castle, NH 03854

46

An early January, 1980 edition of the *Cleveland Press* reports our **Herb Hansell** will be returning to Cleveland very soon and to his old law firm, Jones, Day, Reavis and Pogue. Herb has been serving during the past three years as the Chief Counsel to Secretary of State, Cyrus Vance, in Washington. Herb has distinguished himself in this position, which included writing the difficult language of the Panama Canal Treaty and the Egyptian-Israeli Pact. The *Press* further reports the Hansells will make their home in the Moreland Courts apartments off Shaker Square in Cleveland. . . . **John L. Bateman** is now living in a lovely location along the Huntington (Long Island) harbor with his new wife, Eve, and her four children. John continues his work in nuclear medicine, "terminal care," and related fields. . . . **Ernie Buckman** has been elected Chairman of Oliver Realty after serving nine years as its President. Ernie's son, John, is now a graduate student at the London School of Economics with full tuition, expenses and warm English beer money, courtesy of the old man. Ernie really isn't that old as he reports he had his golf handicap down to 9 last summer. I remember playing golf with Ernie at the 15th Reunion at the Snow Inn at Harwickport on the Cape and I don't recall his golf as outstanding as a 9.

F. Thomas Westcott of Attleboro, Mass., was elected president of the Associated General Contractors of Massachusetts, Inc. at the Association's Annual meeting last August. Previously he had served as director and vice president of the group. Mr. Westcott is president and treasurer of the Westcott Construction Co. . . . **John W. Taylor** writes to say his oldest son, David, graduated from M.I.T. with the class of 1978, with a degree in mechanical engineering. John's youngest son, Alan, is currently a freshman at M.I.T. . . . **Lewis T.**

Mann has changed employment and now works for the Veterans Administration Hospital/University of California Medical School Center in Fresno, California. This is a new branch of the University of California Medical School for the third, fourth and post-graduate years of medical work. John has a joint Civil Service and University of California faculty appointment and a continuing role as clinical chemist and assistant professor in the Department of Pathology.

Ted Heuchling, vice president of Arthur D. Little, Inc., has recently written a short article, "The Future of Nuclear Power Depends on Electric Demand Growth." Ted believes the United States will not give up nuclear power altogether even though our vast coal reserves could make such a moratorium economically bearable. By giving up nuclear power we would forfeit leverage in international nuclear commerce regulations and this could lead to the spread of nuclear weapons. Ted has reduced his 4 per cent annual electric power growth forecast because of general economic conditions and a conservation of electricity caused by rising electricity prices. . . . **Felix E. Browder**, professor of mathematics at the University of Chicago, is a member of the National Research Council's committee on Continuity in Academic Research Performance.

Jonathan C. Ingersoll, of Altos, Calif., Class of 1946, electrical engineering, died in May of 1979.

Please send us a report on your family, work, and achievements. The class would like to hear about you. Until next time. — **Russell K. Dostal**, Secretary, 18837 Palm Cir., Cleveland, OH 44126

48

Graham Sterling, president of our class, is vice president of strategic planning for Analog Devices, Inc. In January, M.I.T. announced that Graham's company has funded a five-year career development professorship in the electrical engineering department. A \$25,000 check, the first installment on Analog Devices' \$125,000 pledge, was presented to M.I.T. president Jerry Weisner by Ray Strata, '57, president, and Graham. Graham wrote that it is in the best interest of not only his company but of New England high technology industry in general to support the ability of M.I.T. to educate the talented people whose skill and imagination make them potential contributors of new knowledge. In addition to funding this professorship, Analog Devices has become a member of the M.I.T. Associates Program and has established a Matching Gifts Program under which the company will match up to \$1,000 in an annual contribution by any employee to an educational institution. Graham was influential in establishing all three of these commitments to M.I.T.

Other members of our class have been instrumental in having their companies provide financial support for M.I.T. I don't feel I can list these earlier contributions, because I may miss some company's generous gift. Maybe you too can influence your company to create a matching gift program or fund a professorship.

Bob Dean, president of Verax Corp., received the Fluids Engineering Award presented by the American Society of Mechanical Engineers at their winter meeting in December. Bob received the award for his "outstanding leadership in extending the frontiers of useful fluids engineering knowledge, his writings and contribution as editor of the *Journal of Fluids Engineering*." Bob is a member of the board of directors of Creare, Inc., which he co-founded in 1961. He is an adjunct professor at Dartmouth College. Bob has been chairman of ASME's fluids engineering division and has been the recipient of other society awards. In 1978 he was made a fellow. He is a member of the National Academy of Engineering, the American Institute of Aeronautics and Astronautics and the Instrument Society of America. Bob and his wife Nancy live in Norwich, Vt.

Jim Guida wrote to say he is still enjoying retirement in Vermont. . . . **Gene Purdum** recently joined the engineering firm of Henningson, Durham and Richardson, Inc., as structural de-

sign engineer. . . . **Jay Lathrop** is completing his 12th year as professor of electrical engineering at Clemson University. Jay is deeply involved with solar energy and is co-inventor of the photochemical converter concept, currently under development at Texas Instruments, for converting sunlight into electricity with built-in storage. . . . **Angelo Giambusso**, manager of a Washington, D.C., operation for Stone and Webster was elected a vice president of the company.

Arthur S. Davis died in November in Pittsburgh. Arthur was vice president and a director of Latrobe Steel Company. He had been with Latrobe for 15 years in various sales, marketing and general management positions. He headed the special manufacturing divisions with plants in three locations. I extend our sympathy to his wife Elaine and her two daughters. — **Marty Billett**, Secretary, 16 Greenwood Ave., Barrington, RI 02806

49

Fred I. Brown was elected a director of NAM last fall, and also was recently reappointed to a fourth term as chairman of the Little Rock Port Authority. I never was good at geography, but I sure didn't know that Little Rock was a seaport. . . . **Mike Scholnick** rises from the unwriting and reports he is in electronic sales and marketing in California. **Bob Waterhouse** and I would imagine that his freeway skills were honed during our Route 20 drive across New York state and back in January, 1949. . . . **Robert Breese** wrote during a long sojourn in the Wadsworth VA Hospital for a hip replacement. He should be out because he was also listed as a possible attendee at the M.I.T. Club of Mexico Fiesta in late March.

Herb Federhen claims seven years with the Defense Advanced Research Products Agency, having a fascinating job "spending the taxpayers money wisely and well." . . . **George Johnson** says that his firm, JAI Engineering, now has 20 years and five offices designing food plants and processes. . . . **Andy Bigus** continues to guide us down the road of successful management with his latest article: "To Plan Your Profits, Pin Down Your Break-Even Points," published in the December issue of *INC* magazine. . . . **J. D. Alden** also joins the literati again with his new book: *The Fleet Submarine in the U.S. Navy*. It is described as an authoritative reference tracing the metamorphosis of the fleet submarine from the T Class to the nuclear sub.

Marge and **Dave Moore** were with us on our 30th in Bermuda and Dave has written twice since. Dave and **Bill Stoney** were both to have been on the same ASCE panel in Atlanta talking about solar energy. Dave made it. Bill didn't. Dave did see a big article and picture about **Milt Bevington's** opening of the first "Energy Store" in Atlanta selling conservation products and services to homeowners and businesses. . . . **Jan Hoegfeldt** has been named a fellow in the American Society for Metals. Jan and Dolores live in Minnetonka, Minn. Jan is principal metallurgist at Honeywell's Defense Systems Division. . . . **Jack Fogarty** lives in Columbia, Md., working for Westinghouse. During the fall Jack and Peggy took a trip back to Plymouth and also stopped by Tech.

Included in classmate news sent to me from the Alumni Office was a football program: M.I.T. vs. N.Y. Maritime, October 13, 1979. Our team is tagged "The Engineers." Why was I sent the program? Because, there on the back cover was a large ad from **Bill Reynolds** and his Reynolds Brothers Co. Nice going, Bill! . . . **Peter Stein** is deeply involved in training programs concerned with the planning, execution, and interpretation of experimental data and measurements. Peter, president of Stein Engineering Services, Phoenix, Ariz., is a fellow of the Instrument Society of America and of the Society for Experimental Stress Analysis.

Time speeds by and Alumni Day 1980 approaches. Please plan to attend the annual Class of 1949 Cocktail Party and Get-Together. Ask the Alumni Office or me for details. If you have read this far in the notes you must enjoy reading about

your classmates. They want to hear about you, too. Please write me with news of yourself or classmates. If you send out Christmas letters please add me to your list. At least, add a note to your Alumni Fund envelope. M.I.T. sends them on to me. — **Paul E. Weamer**, Secretary, 5130 Regent St., Madison, WI 53705

50

We are saddened to hear of the death of **Harlan D. Pickering**. Harlan died on October 25 and at the time of his death was operation research analyst for budget and policy, Federal Railroad Agency of the Department of Transportation in Washington, D.C.

Plans are underway for our Reunion — June 5, 6, 7, and 8. You will be hearing from us soon. — **John T. McKenna**, Secretary, 1 Emerson Place, Apt. 11H, Boston, MA 02114

30th Reunion

52

Dick Wingerson writes that he is continuing to enjoy retirement in Crested Butte, Colo. Dick is chairman of the town board of zoning and architectural review, a member of the county planning commission, and a member of the board of directors of the High Country Citizens' Alliance, Inc. He is active in efforts to preserve and protect the quality of life in the Rocky Mountain region.

. . . **Dirk A. Plummer** has changed jobs. Previously he was a quality assurance specialist, DCASR, Philadelphia, he is now an electronic engineer, Communications Data Division, CORADCOM, U.S. Army, Fort Monmouth, N.J. In the process Dirk has moved from Cherry Hill, N.J., to Sea Bright. He writes that he "likes the new job, people, and locality very much."

Bruce G. Collipp, senior staff engineer with Shell Oil Company, Houston, Tex., was the recipient of the Holley Medal presented by the American Society of Mechanical Engineers at their winter annual meeting in New York City Dec. 2-7. Bruce is receiving the award for his "conception, design and development of the column stabilized semi-submersible drilling vessel and mooring systems as embodied in the *Bluewater I*, and for continuing contributions to the advancement of technology of deep-water drilling platforms and mooring systems." Bruce has been with Shell for 25 years as a division engineer working in research and operations. For 23 of those years his work has been related to offshore operations. In 1956 he conceived the first semi-submersible drilling rig. He also directed the design and completion of the first underwater gas field where the first underwater robots and the first oxygen-helium diving was used. Among other firsts that Bruce took part in were the drilling in icy waters off Alaska; building a rig on the Pacific Coast; and, with Lockheed, building submerged chambers for people to work in on the seafloor. He also directed all marine operations of the 1,025 foot Cognac Platform, the world's biggest and first three-piece platform. He has received many honors including the Silver Cup from M.I.T. for service to ocean engineering in 1978. Since 1969 he has been a guest lecturer at the University of Texas. Bruce and his wife Priscilla reside in Houston, Tex. with their two sons, Richard, 19, and Gary, 21.

Robert W. Stuart, Jr., died in Bedford, Mass., in early September after an extended illness. Mr. Stuart had been a staff engineer at Dynamic Research Corporation's Systems Division in Bedford since 1962. He perfected many U.S. and foreign patents in ship and navigation equipment. From 1952 to 1962 Mr. Stuart worked at General Radio Co. in Concord, Mass. He had a bachelor's and master's degree from M.I.T. in electrical engineering, and was a member of the I.E.E.E. Technical Engineers' Society. Mr. Stuart was a veteran of WWII. He is survived by his wife, Diane, and his two sons.

Robert S. Russell died April 23, 1979. Robert had a bachelor's degree from M.I.T. in course 16, aeronautical engineering. He was a project engi-

neer with the FMC Corporation and resided at 636 Bucher Ave., Santa Clara, Calif. with his wife, Jewell, who has been in very poor health following a stroke two years ago.

Dick Lacey our assistant secretary has written that he saw **Don Grine** last August while Don was taking a short management course at Stanford. Don is senior vice president of the La Jolla division of Systems, Science, and Software, known as S³, whose primary business is contract research and consulting. Dick himself, after working nine years on magnetic bubbles at Hewlett Packard, is now working on other things at Hewlett Packard. He sends his best wishes to the class for the year 1980. — **Arthur S. Turner**, Secretary, 175 Lowell St., Carlisle, MA 01741; **Richard F. Lacey**, Assistant Secretary, 2340 Cowper St., Palo Alto, CA 94301

53

The new year has dawned and according to the president, the "state of the union" and world are not too hot. Until this last week, the east coast has had no snow and the skiing has been lousy or non-existent. Tonight it is snowing here in the suburbs of the nation's capital. However, it doesn't look like it will make up for winter's poor showing to date; that is if the weatherman is right, which he has not been very often. Well, on to the class news.

I just received a letter from **Fred Brecher**. He and his family spent 10 days over the holidays in the Holy Land. Fred was lecturing to the faculty of civil engineering of Technion, the Israel Institute of Technology, on the subject of "High-Strength Concrete Use in the U.S." He reports the response was excellent. Fred said that he has been giving similar lectures in Pennsylvania, appearing before groups such as the Ready Mix Concrete Producers and the Reinforced Concrete Contractors Association of Delaware Valley. He also reports his office is getting busier every day. Keep up the good work Fred.

I also have a few items that were sent in with alumni contributions. **Ben Coe** was selected "Boss of the Year" in the Watertown, N.Y., area. He says his secretary is a great promoter. He indicates he has been pioneering in land use planning and rural local government. I wonder if he would like a job in Washington sorting out this place. . . . **William F. Clause** says his son Donald has received an appointment to the Naval Academy. I wish him good luck. I'm working with a number of retired navy people on their problems and it seems as if today's navy needs a lot of good young officers.

David R. Andelin reports he has retired from McDonnell Douglas after 23 years. He is now a member of the technical staff of Rockwell International Satellite Systems in Seal Beach, Calif. He is also a member of the board of directors of the International Foundation for Telemetry and was last year's general chairman of their international conference. He reports he has matched me with seven children and one grandchild. Congratulations. Who says there is a population growth problem. . . . **G. E. Metcalf** reported he is working for the Safety Training and Research Center of Washington under the Traffic Safety Administration. . . . **Thierry Thys** indicated he is the president of the "Investment Casting Institute."

Well that's all I have for now. Keep sending in the items or I'll be driven to making up news or talking about politics or just passing up some issues. Send your news to — **Gil Gardner**, Secretary, 307 Yoakum Parkway, Apt 626, Alexandria, VA 22304 (703-751-3824)

54

It is now January 22, 1980 as we prepare this column for the March/April *Technology Review*. Believe it or not, we have had essentially no snow in the Boston area up to this date except for a very small storm during December. Obviously, this is a very happy development for many of us, except for those of us who are skiing enthusiasts. It

certainly has also been a plus for our heating bills.

Bob Warshawer has sent us additional information from the reunion on the awards that were given out at our closing dinner dance that we thought you might be interested in. The reunion committee was comprised of: **Dave Howes, Harvey Steinberg, Dean Jacoby, Ruth and Dave Whitehouse, Lou Mahoney, Mickey Sama, George Schwenk, Bob Anslow, Bob Evans, Joe Blake, Wally Boquist, Ann Perry, and Joe Martori.**

Special Awards to Retiring Officers: **Wally Boquist**, president; **Dave Howes**, secretary; **Joe Blake**, class agent; and **Charlie Masison**, assistant secretary.

Special awards for service to the class: **Bob Anslow**, 25th year gift chairman; **Bob Evans**, treasurer; **Mickey Sama**, class vintner; **Lou Mahoney**, assistant secretary; **Anne Perry**, Alumni Office; and **Bob Warshawer**, reunion chairman.

Special Awards from the 20th Reunion: **Harvey Steinberg**, A for effort, and **Frank La Plante**, Made It to Bermuda.

Reunion Awards for Distance: **Hugh Nutley**, Seattle; **Clinford Cole**, Seattle; **Tom Bistis**, Hawaii; **Alfredo Peralta-Maninat**, Caracas, Venezuela; **Tomas Aguerrevere**, Caracas; **Francisco Del Valle**, Chihuahua, Mexico; and **Carlos Roggero**, Lima, Peru.

Jack Award: **Coley Bresse**, **Bob Stewart**, and **Dean Jacoby**.

Wit Award: **Jim Hazard**.
Constant Smile, Great Guy Awards: **Nick Blazensky** and **Bill Eccles**.

Looking the Same as 1954 Award: **Art Coren** and **Joe Scheller**.

Most Kids at the Reunion Award: **Jane Sama** (6).

Architects and Engineers Awards: **Fred Brecher** and **John Bradshaw**.

Coeds Attending: **Barbara (Beyers) Black**, **Jean (White) Fisch**, and **Marilyn (Leader) Shilkoff**.

Geologists Attending: **Carl Schmid**, **Locke Yut**, **Dave Wones**, **Richard Wallace**, and **Stu Smith**.

Graduate Students Attending: **Yehuda Golahny**, **Roy Handwerk**, **Larry Nisbet**, and **Dave Whitehouse**.

M.I.T. Staff Attending: **Bill Combs**, **Aaron Galvin**, and **Paul Gray**.

Retiring Colonel Award: **Phil Sayre**.
Special award to the Chihoski family for lighting up our reunion.

General Attendance Awards: **Sam Loeh**, **Allen Feinberg**, **Ron McKay**, **John Kiley**, **Ted Slosick**, **Dan McNally**, **Jim Klapmaier**, **Larry Weinstein**, **Joe Brazatti**, **Lou Bogar**, **Bill Beals**, **Stan Hoff**, **Rich Miller**, **Mort Davis**, **John Wells**, **Jim Rude**, **Bill Steyart**, **Jack Maier**, **Stan Kolodkin**, **Keith Hertz**, **Mark Caplan**, **Dave Weisen**, **Leon Michelove**, **Sergio Chavez**, and **Larry Leonard**.

In addition to the above awards, it has finally come to our attention that the Youngest Grandparents Award went to **Connie** and **Jim Brown**. The class secretaries have all voted unanimously that **Connie** was the best-looking grandma. We have not received any correspondence from any of our other grandparents out there.

Even though this has been a mild and snowless winter, two of your secretaries are planning to head south shortly. **Jack Kiley** and his wife are leaving from Florida on a Caribbean cruise, and **Lou Mahoney** and his family are going to spend some time in the Orlando and St. Petersburg area. Has anyone been on any interesting trips lately, or might be planning a trip and might like to share their experiences with us?

We regret to report the death of **Bill Wu** on November 30, 1979 in Pittsford, N.Y. We do not have much information at this time on Bill other than he was a Course X man and had received his master's degree in chemical engineering via the Practice School with **Mickey Sama**. We also were saddened to hear of the recent death of **Ben Martin** of South Carolina in early January. Ben was the hockey and lacrosse coach and was known by many of our class. He was a good man and will be missed by many. — **William Combs**, 10 West Newton, Boston, MA 02118; **John Kiley**, 7 Kensington Rd., Woburn, MA 01801; **Louis E.**

Mahoney, 14 Danby Rd., Stoneham, MA 02180; **Dr. Dominick Sama**, Chestnut Hill Rd., Groton, MA 01450

55 25th Reunion

As we approach reunion time, the number of letters and notes regarding your current activities seems to be dwindling. Hopefully, you are merely saving your accounts for conversation at the 25th.

From the few notes which we have received, we hear from **George Goeptert** that he and his family continue to enjoy life in Hong Kong. George reports that over the past year he has had many opportunities to visit Exxon Chemical affiliates throughout the Asia/Pacific region, and he finds it a fast-moving, ever-changing business environment. Perhaps we can hear more come June.

We have recorded a number of achievements of **Russ Meyerand** in these notes in the past year and a half or so. We are now advised that Russ has been promoted by United Technology Corp. to vice president for research and development, in addition to his former duties as director of United Technology's Research Center in East Hartford, Conn. Congratulations once again, Russ.

Finally, **J. Kenneth Watson** (Course VI) dropped us a brief note indicating that his book, *Applications of Magnetism*, will be available as of the publication of these notes through Wiley-Interscience.

Apart from the preceding random notes received from you out there, the western half of this dynamic duo has attempted to get in touch with his twelve class fraternity brothers (Pi Lambda Phi) to trace their activities and encourage their attendance at the reunion in June. As of this writing, I have been in touch with seven of the thirteen members of this subset (the "new math" is not entirely dead), six of whom are hoping to be able to make it in June. The campaign also turned up the following information:

Dick Bergman spent the last couple of years serving as executive director of a White House Task Force on Workplace Safety and Health. He is now working on special projects for the corporate vice president of Equifax, Inc., the company that acquired Systemedics, Inc. (of which he was one of the founders while in Washington). Systemedics was involved in billing and other information and data-processing services for the medical professions. Dick has now returned to Princeton (where he has lived much of the time since graduation) and is also commuting to both Washington and Atlanta where Equifax is headquartered. His daughter Deborah graduated from Barnard last May and is spending this year in Europe traveling and writing. His daughter Susan is a freshman at Alfred University, Alfred, N.Y.

Dick has occasionally seen **Mike Halpern** in Atlanta. The latter has kept busy both as a general contractor and as a member of a local rugby team.

In a short note from New Rochelle, N.Y., **Hal Cohen** indicated that he and his wife Rosalind will also try to get to the 25th. As a caveat, Hal added that his 18-month-old daughter Alexis doesn't give him unlimited freedom to travel.

Dave Fuchs is now living in Mission Viejo, Calif., running a residential real estate brokerage firm. After a number of years in the computer business, Dave recently turned to real estate.

I also heard from **Herman Jacobs**, who has run a management consulting business, Executive Controls, Inc., since 1964, and is still living in Port Washington, N.Y. Herman, who complains about the struggles of running a small management consulting operation, made it into this year's *Who's Who in Finance and Industry*. On the personal side, he reports that he too has a college freshman in the family: his daughter Bettina is presently attending Northwestern.

Dennis Shapiro is still in the Cambridge area and is presently building his second business, Lifeline Systems, Inc., involving medical warning systems for the aged and infirmed. In the last year, Lifeline Systems, Inc. has grown from a program operated in conjunction with one hospital to eighteen operating programs. Denny's wife

Susan is a lawyer specializing in estate and probate practice with Ropes and Gray, one of Boston's most prestigious law firms. They have three children, Allison, 13, Rachel, 11, and Zachary, 9.

Finally, **Walter Shifrin** reported from St. Louis that he is a senior vice president of Consoer, Townsend, and Assoc., consulting engineers. He is primarily working on international marketing. As of July 1, he will be in charge of the company's entire international marketing and production and will be headquartered in Chicago (although he plans to commute from St. Louis for the foreseeable future). Walt's company is working on projects in Australia, Egypt, Panama, Puerto Rico, and the Sudan (traveling about 300,000 miles annually). He concludes that his activities are exciting but exhausting. Finally, on the personal side, Walter and Jennifer have a daughter, Lisa, who is now 13 and in the 7th grade, and a son, Jeffery, who is 11 and in the 6th grade.

Perhaps we can develop a little competition regarding the percentage turnout by a living group or the like at the reunion. It looks as though Pi Lam may have a 50 per cent plus representation in June. Do I hear any higher bids? — Co-Secretaries **Marc S. Gross**, 341 South Bedford Dr., Beverly Hills, CA 90212; **Allan C. Schell**, 19 Wedgemere Avenue, Winchester, MA 01890

57

Congratulations to **Arthur Bergles** on receiving ASME's Heat Transfer Memorial Award presented at the Society's meeting in New York City in December. Arthur is currently in Germany with his wife, Penny, and their two sons — Eric, 15, and Dwight, 11. As the recipient of a Senior U.S. Scientist Award of the Alexander Van Humboldt Foundation of the Federal Republic of Germany, he is doing research at the Institut für Verfahrenstechnik of the University of Hanover while on leave from Iowa State University.

In addition to his duties, as Acting Director of the Medical Service, as reported some months ago, **Dr. Stanley Cortell** is chief, division of nephrology, at St. Luke's Hospital in New York City and associate professor of medicine at the College of Physicians and Surgeons of Columbia University.

John Edward Porter was elected to Congress for the 10th Congressional district in Illinois, January 22, to fill a vacancy. He is a lawyer in Evanston, Ill., 44 years old, was a member of the Beta Gama chapter of the Alpha Tau fraternity while in Cambridge. He previously served six years as a state representative in the Illinois General Assembly.

Bob Rosin and wife, Rosalie, had a splendid trip to the north and west coasts of Scotland and to the Orkney Islands. They particularly enjoyed visiting remote towns and viewing prehistoric remains. Sounds like a fine change of worlds and pace. — **Fred Morefield**, Secretary, Aquetong Rd., Carversville, PA 18913

60 20th Reunion

Dick Bradt, professor of ceramic science and engineering at Penn State, recently returned from a sabbatical leave in Japan, where he was visiting professor of mechanical engineering at the National Defense Academy. . . . **Dick Higgins** continues as professor of physics at the University of Oregon. Current projects include writing a textbook on instrumentation, setting up a helium liquefier for low-temperature materials research, and "getting into" electronic music.

Papken der Torossian presently is vice president and general manager of Plantronics in Santa Cruz. . . . **Mary Tapparo** has joined Evans Electronics as director of computer services. **Frank Tapparo** is with the office of the Secretary of Defense. Now that their first-born is in the college-search mode, Frank asks, "Where, oh where is that \$1100/year Tech tuition now that I need you?"

Don't forget the 20th reunion this June. —

62

Terry Kohler is busy campaigning for election to the U.S. Senate from Wisconsin. Both Terry's father and grandfather were governors of Wisconsin. He is currently president of the Vollrath Co. in Sheboygan, a manufacturer of food service and hospital products. ... **Alan Loss** is president of Lawrence Assoc. in Marblehead, Mass., a management consulting firm. He has recently incorporated Asset Management Technology Corp. to cater to a larger population of institutional investors. ... **Jeremy Goldberg** writes that he and his family make use of bicycles and the subway in Washington, D.C. and that **Victor Schneider** has moved to Washington from Los Angeles to work for the Institute for Defense Analyses.

Mickey Haney has been with TRW for ten years and lives in Manhattan Beach, Calif. He has four daughters ranging in age from 6 months to 10 years. ... **Harold Metcalf** reports that Prentice-Hall has published his book *Topics in Classical Biophysics*. ... **Peter Goldstein** spends his time delivering new aircraft from the U.S. to Europe, Africa, and Australia. He is not sure whether his ability to find his destination is a result of studying probability or his training at the M.I.T. sailing pavilion. ... Let's hear from more of you out there in alumni land. — **John Prussing**, Secretary, 2106 Grange Dr., Urbana, IL 61801

63

This month's column exhausts my little backlog of news. I will be counting on some letters or Alumni Fund flaps from you to keep me going over the next few months. **Ed Dudewicz** has just become the editor of the new *American Journal of Mathematical and Management Sciences*. He looks forward to hearing from many of his old M.I.T. friends as contributors to the journal. ... **Dave Caldwell** has been working for Texas Instrument's consumer products division in Lubbock, Texas since November, 1977. He is doing software systems design for TI's calculator products. Dave is still a bachelor. ... **Bob Yess** writes that he is still unemployed, and would appreciate job offers from any classmates. Bob says he will not refuse any reasonable offer. ... **Dave Marks** informs us that he is married, has one child, and is working at the St. Regis Hotel in New York City as a room service clerk and cashier. He is also making movies, renovating lofts, and wondering how his M.I.T. career led to his present career. ... **Don Yansen** is currently consulting in electro-optics, mostly at M.I.T. Lincoln Labs. Don is raising two gymnastics crazed daughters and chopping a lot of wood for a wood stove. ... **William Vachon** is also a consultant in the Boston area. Bill is working in the solar and wind energy field for Arthur D. Little in Cambridge.

Elliot Bird is still chairman of the math department at C.W. Post College in Long Island, N.Y., and is very active in the field of math education. He was recently elected vice president of the local math supervisors organization. Elliot has recently started running, but says that he is too impatient — he occasionally overdoes it and has to sit out a week to recuperate. He is, however, determined to race next fall. ... **John Hornstein** and his wife, Julie Larsen, live in Silver Spring, Md. For the last five years John has worked for Computer Sciences Corporation in Silver Spring, on wave propagation in random media, and, more recently on estimating temperatures in planetary atmospheres from infrared data. John has been involved with some of the data from the Voyager space flights.

I recently received a newsletter from former class president and current state representative, **Woods Bowman**'s office in Chicago. He is active in many areas of legislation, but the newsletter focused on his activities as a member of the task force on tax relief and tax reform. One of Woody's

ills eliminates the sales tax on food and medicines. Woody is also a runner.

We were saddened to receive a letter from Lee P. Tolman, '36, informing us of the death of his nephew, **Stuart Dreger**. Stuart was on a business trip from Whitewater, Wis. to Detroit last October 10 when his light aircraft disappeared into Lake Michigan. After graduation he had been with the International Division of Goodyear, and for the past six years was president of Dreger, Inc., manufacturers representatives. He is survived by a daughter, Marcia, and by his parents, Mr. and Mrs. Herbert Dreger of Brownsville, Texas. — **Michael Bertin**, Secretary, 18022 Gillman St., Irvine, CA 92715

64

Well, not many envelopes this month, so unless our fellow classmates want a monthly diary of the Schlosser clan's comings and goings — we need news! Please send news via letters, postcards, and, most importantly, the alumni fund envelopes.

Mike Auerbach was recently promoted to manager of applications development of Pfizer's Specialty Chemicals Department. He just spent three weeks in Europe: one week in Nice at the International Desalination Congress, where he gave a paper, and two weeks in England, Germany, France, and the Netherlands conducting a market opportunity survey for Pfizer. Mike said he enjoyed our 15th reunion weekend but was disappointed so few who declared intentions to go actually showed up.

Joe Kasper was recently promoted to director of the Strategic Systems Division at TASC. His wife Pat is a serious sculptor with a write-up in *Yankee* magazine and artwork exhibited all over the country. Joe is serving as an educational counselor for three Merrimack Valley (Mass.) high schools. He and Pat keep reasonably regular contact with classmates Ellen and Gary Walpert and Cheryl and Bill O'Halloran.

Maury Shulman says "all is well in Merion, Pa." He is now pushing the state-of-the-art in microprocessor technology with his microcomputer. ... Our last envelope was from **Roger Parks**. He has completed his Ph.D. in political science at Indiana. Roger is working in Bloomington at the Workshop in Political Theory and Policy Analysis. He says, "Most important is our beautiful son, Josh, three and a half."

A couple of sad notes. Our classmate **Roy Dewhirst** passed away this past October; we have no other details at this time. Also, Newton Teixeira of the class of '44 passed away in January. I mention Newt because he was a friend and a colleague (when I worked at RCA), in addition to having been a fine, sensitive, and intelligent human being. Marlene and I last visited with him at our fifteenth (his thirty-fifth!) reunion last June. Our heartfelt condolences to Melissa, the children, the rest of the family, and his many friends. We'll all miss him! Ciao! — **Steve Schlosser**, Secretary, 11129 Deborah Dr., Potomac, MD 20854

65

Art Bushkin wrote to say that they had just bought a new home in Virginia. Gladys and **Jim Taylor** and their children Kim (ten), Jeff (nine) and Paul (four) are back in New England after twelve years in Texas and Louisiana. They are living in Connecticut and Jim is working in New York City as employee relations planning manager for Exxon. ... **Joe Dyro** announced the birth of their second child, son Peter Wood, on August 12, 1979.

Frank Gerstle is still with Sandia as supervisor of Composite Materials Development; the group is responsible for high performance fibre composites. For the past two years Frank has served on the National Materials Advisory Board Committee on Composites, and remains active in the local mountain rescue organization. Frank's stated goal in life: "make the world safe for middle managers." **Alan Craig Leslie** has formed ACL Management Services, providing financial and

management consulting and data processing services to companies in such fields as investment banking, consumer products, health and film production.

The 1979 Annual Report of the Worcester Foundation for Experimental Biology featured a nice report on **Foteos Macrides**, who is a senior scientist at that institution. Foteos left medical school after a year to return to M.I.T. for a Ph.D. in neurobiology and stayed on for post-doctoral work. At the Worcester Foundation he is working on the limbic system of the brain, studying how the sense of smell determines social behaviors in hamsters. ... A press release brought me up to date on Susan and **Stephen Schutz**. Steve's airbrush drawings illustrate the poetry of his wife, and more than two million copies of their six books have been sold in the United States. The Schutz's books and cards are also being widely published abroad.

By now you should all have received at least one mailing about our glorious Fifteenth! Friday, June 6, is Technology Day. Class activities will start that evening with an informal wine and cheese party. Saturday will feature organized activities on campus, including swimming and tennis, and sightseeing trips around historic Boston. Saturday night will feature an elegant cocktail party and dinner dance high over the city. For those still around, there will be a Sunday breakfast. All this for a paltry \$40. Y'all come! And please, please, everyone, coming to reunion or not, remember to fill out the biographical questionnaire, which will be used to prepare the class book. — **Edward P. Hoffer**, M.D., Secretary, 12 Upland Rd., Wellesley, MA 01605

66

In 1979, I rose to an even higher state of over-qualification for everything. When I received my post-master's certificate in health care administration at George Washington University, my name was the only one on the program with five degrees. ... Two of our classmates have been much more profitably engaged in entrepreneurial activities: **D.O. Smart** is president of the Calibre Group, Ltd., in Kansas City where he puts his concern for individual productivity and organizational profitability to work by serving as a consultant specialist in improving leadership and human performance. If your company is having difficulty, give him a call. ... **John K. Freeman** formed a construction partnership (Rosenberg, Freeman, and Associates) to reclaim economically or functionally obsolete buildings for housing throughout the midwest and mid-Atlantic states. Watch out Building 20.

Dr. Morton E. Sherman has joined in the local governmental process as a member (duly elected to be sure) of the board of directors of the Aurora (Ill.) Chamber of Commerce. ... **Harry Moser** in Cleveland has been running also; but for fun, if you can call breaking 40 minutes in a 10,000 meter (6.5 minutes per mile) run fun. ... **Carl Jones III** writes that he attended his wife's last reunion and saw **Phil Schwartz** up from Virginia, Carolyn and **Dan Dedrick**, and **Roger Samuel**. Carl's two-and-a-half-year-old son Matthew loved meeting everyone too. ... **John Bobbitt** has left Iowa State and the academic game for the greener pastures of CONOCO in Ponca City, Oklahoma. John decided to cultivate an ear for listening to the grass grow. His wife Peggy and their three children love Oklahoma, too.

Richard Gray is in his third year designing machinery at Millipore in Bedford, Mass. He, his wife and daughter have a pleasant life in Brookline. Dick only leaves them to work and go sailing out of Marblehead. ... **Mark Yogman** is working at Mobay producing more juice for the rubber ducky RIM urethane bumpers used by Motown. ... **Peter Lobban** is still working as an electrical engineer at Varian and is in charge of a small digital group. Peter: please send me a set of the *Radar Through the Ages* advertisements that Varian acquired when it purchased the old Beaumac Tube company. Actually I'd really like the old Beaumac versions because they are

better; the verses were written to rhyme with Beaumas. They would be delightful to share with our classmates. — **Joseph Patterson**, Secretary, 1403 Gerard St., Rockville, MD 20850

67

Dave McMillan and his wife Marilyn report that they have settled into their colonial "handyman special" in Winchester, Mass. Their two children, ages nine and eight, are into lots of activities, while Marilyn is working at M.I.T. as a senior analyst in administrative information systems development. Dave works at MITRE. ... **Roy Gamse** is deputy assistant administrator for planning and evaluation at the U.S. Environmental Protection Agency. His wife Joyce works at the Library of Congress Publishing Office and recently had her first article published by the *Washington Post*. ... **Mike Rosenblum** writes that he and his wife Kiki attended the wedding of **Larry Gottlieb** and Christine Falter last year in Santa Barbara, California. Mike also reports that **Jim Foster** and his family are doing fine.

While on leave from the University of Michigan at Ann Arbor, **Edie Goldenberg** is working on reforming the federal civil service at the new Office of Personnel Management. ... **John Child** is an attorney with Synnected and Lechner, a firm specializing in patents, trademarks, copyright, and antitrust law in Philadelphia. ... **Bonnie Lynn Webber** is currently teaching in the Department of Computer and Information Science at the University of Pennsylvania. ... **John Podolsky** writes that he is forming a company specializing in computer hardware development.

During his 1978-1979 sabbatical leave from the University of Minnesota, **Robert Hardt** spent his time at the Institut des Hautes Etudes in Bures-sur-Yvette, France and the University of Melbourne in Australia. ... **John Patterson** has graduated from the Navy Test Pilot School, having completed 11 months of training in the evaluation of flying qualities, performance and avionics systems. His family now includes daughter Emily, born last Halloween, as well as son Ned, age three. ... During his leave of absence last year, **Alan Hausrath** taught mathematics at the Universidad de los Andes in Merida, Venezuela. He spent his vacations sightseeing in Venezuela, Peru, and Ecuador.

As president of Participation Systems, Inc., **Chandler Stevens** has developed a computer conferencing network involving half the state legislatures, Puerto Rico's legislature, the Congressional Clearinghouse on the Future, the National Conference of State Legislatures, the White House, several federal agencies, a few local governments and various technical resource organizations. ... **Dennis Kalla** moved to Conrail in Philadelphia, where he is currently in a training program for managers in the transportation department. — **Jim Swanson**, Secretary, 878 Hoffman Terrace, Los Altos, CA 94022

68

We would like to start this month's column with an apology to all of you for missing a few deadlines in the past few months. You may remember that I started a new job in September with the FCC and initially things were rather hectic. They're still hectic, but at least they're more organized so I've been able to start writing again from here along the banks of the Potomac. ... Some of the '68 spouses out there may wonder why they never see their beloved's name in these sacred pages. There is a cure for this problem. Turn him/her in to the class secretaries yourself! This is exactly what Diane Pack did, so we are pleased to give her the class hero award and quote generously from her letter: "My husband **David Pack** was in your class of '68. Here is a brief summation of his life after graduation. He worked as an aeronautical engineer for Lockheed in Burbank while completing his masters in engineering management. Before we met, he backpacked around Europe and Africa for a year, then worked for

Burroughs Corp. We married in 1973. I continued teaching elementary education and we saved up for our trip around the world. We backpacked through Europe (east and west) lived in Israel, worked on a kibbutz, and while traveling through Africa, I became pregnant with our first child, Shelley (born February 27, 1976). We completed our travels in the far east then reached home in L.A. in June, 1975. Since our return, David has done very well building his own computer software company, Westland Software House, Inc. He travels a lot now, but not for pleasure. Westland is now nationwide, specializing in in-house computer systems for doctors' accounting. Our second daughter, Melissa, was born in June, 1978, so we missed the reunion, but hope to be in Boston soon with our two daughters for a vacation." Diane adds that both her father-in-law and brother-in-law are M.I.T. graduates and that she hopes her daughters will be able to go to M.I.T.

Michael Yokell has left the Solar Energy Research Institute and formed his own firm, Resource Management Consultants, in Boulder. He is working on a textbook entitled *The Economics of Solar and Alternative Energy Technologies*. ... Back in Middletown, Conn., **Dan Belin** has joined a medical practice in rheumatology. After attending Harvard Medical School, he did his internship and residency in internal medicine at the University of Michigan and subsequently served as a specialist in internal medicine at Langley Air Force Base Hospital. His fellowship training in rheumatology was done at the University of Connecticut Health Center, Farmington. ... In 1978 **Karl Hella** received his Ph.D. in economics from Washington University of St. Louis. Since then he has been teaching at St. Olaf College in Northfield, Minnesota.

Charles Meyer, Jr. is living in Pound Ridge, N.Y., and enjoying "country" life. He recently joined Weight Watchers International as Director of Marketing and hopes to shed a few pounds himself. ... **Leonard Horowitz** "gave up electrical engineering" in 1971 when he decided that he was tired of "being zapped" and opened a natural food store in Cleveland. He later opened a restaurant, Earth by April. In January, 1979, he married Cheryl Peres. Now he's sold the store and is expanding the restaurant. ... Another refugee from the engineering biz is **Bill Charles**, who recently got an M.B.A. from U.C.L.A. and is now trading stock options on the Pacific Exchange in San Francisco. ...

Jack Zeigler can't understand why M.I.T.'s computer still has his title as "Lt." even though he left the Navy over five years ago. He also reports that on September 29, 1979, he married Aslang Bergersen from Skarnes, Norway. Jack is working in Oslo on the software for a portable digital switch at Standard Telefon og Kabelfabrik A/S.

That's about all we have for now. We hope to keep to a more steady schedule now, but we call on all of you to help. Please drop us a note (or turn in your spouse). — **Gail and Mike Marcus**, Secretaries, 2207 Redfield Dr., Falls Church, VA 22043

69

Well, another issue deadline met, but not too much to report. I drove to Omaha over Christmas — no snow the entire trip. People in Cambridge are beginning to hope we won't get any snow the entire winter!

Alan Goldberg is currently commuting between Danbury, Conn., where he's on the space telescope project with Perkin Elmer, and Cambridge, where his wife Pamela DeSmidt ('76) has been attending the Sloan School since September. Alan and Pamela are still running Creative Telephony if anyone out there is interested in adding to their collection of telephone related equipment.

Living happily in a rehabbed Cambridge brownstone is **David Lyon**. He was recently promoted to director of engineering at Intertel, Inc., where he has been working since getting his Ph.D. in electrical engineering at M.I.T. in 1972.

Oakley E. Van Slyke, III recently joined Warren, McVeigh and Griffin as a consulting actuary. The

firm does risk management and insurance consulting for corporations across the country.

Finally, a brief note from **Michael Underhill** saying that he's just started as an assistant professor in the School of Architecture at Rice University.

Pretty sparse this month. If I'd been busier you'd be hearing all about it, so send in those cards and letters to **Robert K. Wiener**, Secretary, Box 27, M.I.T. Branch, Cambridge, MA 02139

70

10th Reunion

Our class is in need of a coordinator for the ten-year reunion to be held on June 5-8. All persons interested should contact Ann Perry at the Institute.

The volume of correspondence has increased significantly. **Thomas Halket** writes that he married Amy Levin (Wellesley '71) and they have a son, Jonathan. Thomas is associated with the New York law firm of Dewey, Ballantine and is actively involved in the ABA committee on space law. ... **Peter McCall** sent a Christmas card with a special message and also indicated he continues to be involved in tax work in San Diego and looks forward to seeing all his friends at the reunion. ... Saunderstown, R.I., is the home of **Michael Prager** and he is presently enrolled in the Graduate School of Oceanography. His letter revealed that he enjoys the scholastic life, rural area, good beaches and scuba diving after eight years at Electronics for Medicine in White Plains. Michael is trying to locate **Steve Girshick**, if someone can help.

Marvin Greenberg is finishing his third year of his ophthalmology residency at Georgetown and now has a second daughter, Pamela, in addition to Jessica. ... **Carl Yankowski** is now U.S. Group Director of Marketing for Pepsi-Cola Co. ... **Bruce Lautenschlager** wrote a two-page letter revealing that he graduated in May with an M.S. in accounting from the University of Wisconsin-Milwaukee and was elected to Beta Gamma Sigma. Bruce has taken the CPA exam; moved into a new house; his daughters are looking forward to school and he has a position with Parker Pen Co. in Janesville as senior staff accountant. The letter asked all those classmates who don't communicate to write and that anyone in the area stop by.

Hamilton, Ontario, now has two Campings practicing law. **Fred** is in his third year as a Crown Prosecutor involved in all cases from drunk driving to murder and Cynthia has found a position in private practice there. ... Received a comment from **Richard Brooks**. He is attempting to patent the results of his software work at Polaroid: a micro-processor film evaluation system. Margie and he are expecting their first child. ... "New job," new house, new family in Arlington, Va., **Tom Hafer** informs us. ... **Mike Bromberg** indicates that being a design consultant of energy controllers, telecommunication devices and other items is fun. Also, his flexible hours allow him to play rugby and scale the local mountains.

The last time we left **Tom Derby** in Atlanta, he was enjoying himself, family and computerized energy management services. Evidently he still has a good thing going. ... Perhaps the next producer of a disaster movie will be **Howard Bluestein**. He filmed a spectacular multiple vortex tornado near Wichita Falls in conjunction with his assistant professorship in meteorology at the University of Oklahoma.

Joel Mosher is at JPL processing pictures via computer mosaics from the Voyager trip to Jupiter. ... **Michael Hoffman** should be pleased with M.I.T.'s football schedule in that he is in Pasadena working as the Bateman Instructor in mathematics at Cal Tech and waiting for Rose Bowls and other football contests. ... Like others making plans for the reunion, **Earl Withycombe** has requested to hear from all 1968 Holman residents. He is county supervisor in Downville, Calif., in addition to his air pollution consulting. — **Robert Vegeler**, Secretary, 2120 Fort Wayne National Bank Building, Fort Wayne, IN 46802

Sally (Harvey) Cortese writes: "Left the U.S. Environmental Protection Agency in 1977 to go back to school 'up the street.' Received M.B.A. from Harvard Graduate School of Business Administration, June, 1979. I work at Digital Equipment Corp. in Maynard as a management scientist. I am serving as president of the Boston Section, Society of Women Engineers and recently chartered a new student section of S.W.E. at M.I.T. Have seen **Diane (Feldman) Eisenstat** (also an M.B.A.) and **Carol Seligson**." ... **Donald Feith** married June Caplan and has started his own company, Dalco Speaker Works, which makes hi-fi speaker systems.

Grethe B. Holby received an award from the National Opera Institute in opera stage direction. She will apprentice with two stage directors in opera for the year. ... **Phillippe Annez** is finishing his Ph.D. thesis in Course 11. ... **Harold Nussbaum** writes: "I'm beginning my eighth as a social worker for the Idaho Dept. of Health and Welfare. I enjoyed another successful and exciting season of coed slow pitch softball. In May I played a major portion of a memorial piano recital for Alexander Tcherepnin at Boise State University. I also do quite a bit of running, and hope to increase the amount of writing I do."

Mike Gilmore writes: "I still reside in Idaho and am anxiously awaiting the skiing season. I enjoy Laura Middleton's class notes. I am involved in very exciting litigation which should determine the energy and agricultural future of Southern Idaho's Snake River plain for the remainder of the century, and am taking bets on whether I can retain my teenage appetite and metabolism into my thirties." ... My apologies to **Vincent Stephen Darago**: his company put the first non-PBS show over the PBS satellite. Many errors find their way onto these pages, and you can prevent them by *Printing Very Plainly* when you correspond.

Philip R. Widing married on January 2, 1980; he did not say to whom. ... **James G. O'Connell** and his wife Susan are proud parents of Jonathan, born April 7, 1979. James has been employed by Ortho Instruments (a division of Johnson and Johnson) designing blood cell counting instruments. ... **Rene M. Haas** reports that his company, Henckels, Haas and Brown, Inc. (an electrical engineering software firm) started by Rene and Lutz P. Henckels, '67, and Kenneth M. Brown, '71, is flourishing with 30 employees.

Bill Birthel is in Maine designing computers for paper plant control and designing sets and lights for amateur theatre productions, the most recent of which was *The Sound of Music*. Bill reports that the production received reviews like "awe inspiring" and "community theatre at its best" and played for three, sold-out weeks. ... **George Providakes** is completing his Ph.D. in electrical engineering at Cornell. He married Catherine Creecy in May, 1979 and she is earning her Ph.D. in German literature. George writes that **Alex Sugaroff** is also in Ithaca completing the computer control and diagnostics on the Wilson Synchrotron Colliding Beam Machine (I wonder if he's putting me on). Alex's wife, Jenny, is in her final year at the Cornell Veterinarian's School.

Start thinking about our ten-year reunion in 1981 and saving your money to travel to Boston. I know the Alumni Association will help us plan a great celebration: imagine all of us having graduated from the 'Tute, survived the next ten years and, for most of us attained the dreaded age of 30! Keep your cards and letters coming in, but *Print Plainly*. — **R. Hall Moorman**, Secretary, P.O. Box 1808, Brenham, TX 77833

Eugene Kroch writes, "Having received my Ph.D. in economics from Harvard in November, 1978, I am currently teaching at Columbia. This is my second year here, but I have been maintaining my ties with Cambridge and M.I.T. I am conducting some research with Prof. Gordon Kaufman at the Sloan School." ... **Michael Greenspan** notes,

"I've just moved to St. Louis, where I am working for McDonnell Douglas, and working with an evangelical church that has lots of other Jewish Christians in it."

Richard Arratia finished his Ph.D. in math at Wisconsin with a thesis entitled, "Coalescing Brownian Motions on the Line" and is now Hendrick assistant professor at U.C.L.A. ... **Bob Fourer** is teaching operations research in the Department of Industrial Engineering and Management Sciences at Northwestern. ... **Victor Kalasinsky** is assistant professor at Mississippi State University. ... **Paul Hendrickson** has his own company, PH Associates, Inc., which is in its fifth year providing management consulting services, primarily to the banking industry. — **Dick Fletcher**, Secretary, 135 West St., Braintree, MA 02184

Well, hey! **Tom Stagliano** announces in a note that he is working in Burlington, Mass., in aeronautical consulting with several old M.I.T. alums. Though invited to try out with the U.S. Olympic hockey team, he was cut on the final day. ... **Jim Gregory** is the father of Jennifer Anne, born November 29, 1979. Jim is at Mobil Tyco in Waltham. ... **Ronnie Rybstein** is a consulting actuary for Touche Ross and Co. He is heavily involved in tournament bridge.

Jean Renard Ward is to be married on July 26 to Maria Reuters in Germany. They will live in Boston. ... **Steve Waller** and Jane are in med school at the Uniformed Services University in Bethesda, Md. And ?????????? (got to sign those cards, boys) is finishing the internal residency at University of California — Irvine. ??? (If I may be familiar) has become the owner of a Long Beach condominium. And ... **Tony Scandora** will marry Kathy Tate in August, where yours vocally is to do gross injustice to Schubert's Ave Maria. Me? I haven't looked lately. — **Robert M. O. Sutton**, Secretary, 2005 Cedarwood, Carrollton, TX 75006

Happy trails (and income tax) to you, it seems we meet again. Not a lot of news this time, so as threatened, some of this column will be made up. Let's see (assuming it isn't killed in the editing room) if you can guess which item is not real news.

The Blue Ribbon First Prize Outstanding Effort Good-Show Award goes to **Lenny Davis**, the first class member to write your faithful scribe with news and gossip. Lenny sweated 4½ years at U.C.L.A. for his Ph.D. in organic chemistry and is now a senior research chemist for Monsanto in Akron. He is happily settled in there but says the "rubber capital of the world" is quite a switch from Boston. Lenny also mentions **Bruce Seiler** as still being at U.C.L.A. in inorganic chemistry, as well as my good buddy **Tom Wolff**. In the summer of 1974 Tom and I got on the backs of our motorcycles and played easy rider in a generally westward direction through the summer. We split up in Salt Lake City. Tom went north to the Grand Tetons and I continued west to San Francisco and that was the last I heard of him. Lenny says Tom's getting married and "seems pretty happy." Almost as if in affirmation, a letter from the man himself arrived two days after Lenny's. He's in love. His fiancée's name is Marcy Epstein and they've set the date for April 20. Of her, he says "I fell in love almost immediately." Of the wedding, he says, "I can hardly wait!" Congratulations and good luck from the entire Class to you two! That's what the world needs, more love.

The Alumni Fund envelope pile is quite large this time. The final 1979 total contribution from our class was \$3,052.90. Thank you.

Paul Schindler's envelope was full of news already reported here, but it doesn't hurt the ego to see your name in print. He's West Coast editor for *Computer Systems News* out of San Francisco. **Donn Swartz** has returned from five years

overseas with Firestone to become senior analyst, Corporate Strategic Planning at the Firestone Headquarters in Akron. **Gary Raymond**'s Triple-A Specialty Co. must be doing very well. He recently went to Anaheim to set up a new rubber molding division of his Chicago-based company. Amazing coincidence that the colors of jealousy and money are both green, isn't it?

Did you know that M.I.T. has a big high-priced clipping service that does nothing else all day but scan newspapers for stories about its faithful alumni? Did you care? One recent article in the *Apothecary* (New Mexico) *Gazette* details the antics of **Mark Abkowitz** and his attempts to grow dehydrated watermelons. The secret process involves organic fertilizer, intensive growing techniques, and three hours of prayer and meditation per watermelon per day. We'll try to get pictures for next issue.

Jamie Stolper gave birth to a son back in October. She and husband David are living in Newton from whence she commutes to Data Resources. By the time you read this, she and David will be celebrating their second wedding anniversary (April 9).

Finalment, **Ashok Boghani** recently changed jobs from Foster Miller Assoc. to Arthur D. Little as a member of their professional staff. As many of you know, the people at Arthur D. Little succeeded in making a silk purse out of an extract of sow's ears but did you also know that the Arthur D. Little people also succeeded in floating a lead balloon? See what you can learn by reading *Technology Review*. Please, please write. — **Lionel Goulet**, Secretary, 34 Tremlett Sq., Dorchester, MA 02124; **Jim Gokhale**, Co-Secretary, 6 Burton St., Arlington, MA 02174

I am terribly sorry I missed getting a column into the last issue but the deadline arrived at a particularly hectic pre-holiday time. But at least we have plenty of news to fill this one.

Peter J. Mancuso was recently married (August 8, 1979) to Karen Washington. He was also recently promoted from District Court Trial Bureau to the County Court Trial Bureau of the Nassau County, N.Y. D.A.'s office where he will be responsible for the prosecution of felonies. ...

Kathryn J. (Browning) Hoffmann reports, "Many changes have come in my life since I last saw M.I.T. I went to graduate school at Columbia University in archaeology. There I found my life in Jesus Christ, and soon after met and married my husband, Kenneth Hoffmann. We now have a one-and-a-half-year-old son. Still working towards my Ph.D. Would love to hear from anyone." Kathryn included her address, which is 1720 N. Thompson Dr., Bay Shore, N.Y. 11706. ... **Richard Withers** married a Simmons woman in 1974 and received his Sc.D. from M.I.T.'s electrical department in 1978. Presently he is working at Lincoln Lab, residing in Bedford, and promoting bicycle transportation as president of the Boston Area Bicycle Coalition. ... **Woody Pidcock** married Candace Baltzelle on September 1, 1979 at Resurrection Evangelical Lutheran Church in Roxbury, MA. He bought a house in Mattapan and is still employed as a Systems Analyst at BP Technical Services, Inc. in Cambridge. He is preparing a paper on "Bandwidth Minimization of Planar Graphs" in his spare time. Says Woody, "Married life is great!"

... **Edward Capparelli** wrote that he was married on June 2, 1979, to Gillian E. Blauvelt (Middlebury '75, Columbia School of Nursing '77) in a beautiful garden ceremony at Franklin Lakes, N.J. Edward was graduated from Mt. Sinai School of Medicine on May 31, 1979, and is currently in his first year of a family practice residency program at McAllen, Tex. which he is greatly enjoying. ... **Gerard Rudisin** finished a master's degree in Computer Science at U.C.L.A., working on reliable distributed computer system architecture. He will continue at U.C.L.A., implementing the system which he has been involved in designing. He is getting married in August, 1980. ... **Bradford Hampson** was married on September 30, 1979 to Odette M. Hebert, in Waltham, MA. They are

living in Marlboro. He is presently a senior software engineer with Prime Computer, Inc. of Framingham, and is still enjoying himself. He says, "I've also been fortunate to be able to serve M.I.T. as a member of the Educational Council — a very rewarding endeavour." ... **Woody Prieb-jivat** wrote to say that he had come back to Cambridge to attend the wedding of **Masato Nagase** and Naoka Kosaka at the M.I.T. Chapel on October 28, 1979. Masato is now working in the Aerospace Department of Mitsubishi Corporation. He seems to be very successful both in his work and dealing with his workmates, according to Woody, who, by the way, is still at the Graduate School of Business at the University of Chicago working toward a Ph.D. ... **Andrij R. Neczwid** married Christine Pundy on October 29, 1977, and she is now a practicing ophthalmologist (M.D.). Andrij is working at Motorola in the Data Systems Research Laboratory in Schaumburg, IL. They just bought a house in Arlington Heights, and they were expecting their first child in January. ... **Mark Czerwinski** married Barbara Manuck in 1978. Mark spent 1975-1979 getting a Ph.D. in electrical engineering at Carnegie-Mellon University. He's now working at Lincoln Lab. He and Barbara have bought a house in Lexington and are "enjoying the bourgeois life." ... Whew, what a lot of marriages. Congratulations to all of you.

F. Patrick Schultz moved to San Francisco from Houston, is living in The City on Russian Hill, and is working for Genstar Pacific Investments. ... **Kenneth M. Deemer** recently received an M.B.A. from Carnegie-Mellon University and is now a product manager for Data Systems Design, a privately held manufacturer of computer mass storage peripherals in Santa Clara, Calif. ... **P. Michael Jung** is currently serving as law clerk to Judge Patrick E. Higginbotham of the U.S. District Court in Dallas, Tex. ... **Karen E. (Irwin) Chen** is still a graduate student at UC Berkeley, "but the end seems more tangible now." She's working on developing a microfabricated millimeter-wave detector. She spent the month of September traveling in Europe and had a terrific time. ... **Alan H. Katz** was graduated in May '79 from Tulane University School of Law. He was admitted to the Louisiana Bar Association on October 5, 1979, and is currently clerking for a justice of the Louisiana Supreme Court. ... In 1978, **Barbara Moore** was graduated from Harvard Law School. She is practicing law in Boston with Hale and Dorr, specializing in litigation.

William W. Rowe is "working very hard doing my internship in internal medicine in Chicago, but still find time to fly and engage in other long-time hobbies. Just finished a backpack trip in Colorado at the peak of fall colors." ... Also interning in internal medicine is **Greg W. Rothman** at Lenox Hill Hospital in N.Y.C. On internship, Greg had this to say: "I wouldn't wish it on my worst enemy." ... **David Dinhofer** is currently completing his last year in medical school at Tulane. Hello to you too, David.

Arthur W. Apter was a graduate student in the Math Department at M.I.T. from September 1975 to June 1978 and then received his Ph.D. Until June 1979, he was an instructor in the Math Department. He is currently an assistant professor in the Math Department at the University of Miami in Coral Gables, Fla. ... According to a Navy news release dated October 11, 1979, **Jeff Schweiger** has been designated a patrol plane commander for Patrol Squadron 19 at the Naval Air Station, Moffett Field, Calif. Jeff will be in charge of a flight crew and responsible for the execution of ocean surveillance, aerial reconnaissance, and search and rescue missions. ... **Stephen Chapman** left (retired from) Stone and Webster Engineering Corp. in August 1979 to pursue a fulltime commitment (as a principal) to commercial realty development and management under the name Heritage Associates/Heritage Development. Stephen owns and manages a number of rental units in urban and suburban Boston and is presently engaged in development (through conversion) of a number of condominiums in Boston's Back Bay. Stephen, might you have have your landlordly eyes set on 416 Marlboro, the former hallowed home of **Cliff**

Wald, Lenny Deroma and **Evan Schwartz**, with whom I enjoyed a dinner in N.Y.C. over the holidays? Please promise me you won't spread into Cambridge and convert my dwelling; I live in fear of this, as do many inveterate renters.

Remember a while back when I reported that **Jon Sass** would like to have your business cards, but I wasn't sure whether he was serious or not? Well, he wasn't joking; he really does collect business cards, so if you can spare one, you might like to send it to him at: 72 Curtis Place, Amherst, MA 01002. By the way, Jon was married this past summer to Pat Harper, a graduate of URI. They were in California for a couple of years where he taught junior high school. He is now teaching in an alternative high school in Holyoke. He loves working with kids, especially city kids, although he says, "Few kids equal the Somerville kids with whom I worked before."

That wraps it up. Are you getting psyched for our reunion? Hope to see you soon. — **Jennifer Gordon**, 22 Centre St. No. 9, Cambridge, MA 02139

76

The mails have once again yielded their bounty. However, I urge you all to write, especially those from whom I have not yet had word.

Peter Fontneau has been appointed a Lieutenant Commander in the Coast Guard and is now stationed in the 12th Coast Guard District Office in San Francisco. ... **Jim Wodja** is now a technical programmer for GTE Automatic Electric. He specializes in data communications systems. ... **Jacalyn** and **Thomas Bracewell** proudly send word on the birth of their daughter, Elizabeth Allison. Our congrats, naturally.

I apologize for the fact that some of this news is dated. I write it up at the earliest opportunity, but it is published a couple of months later because of *T.R.*'s production schedule. I shall be playing in the musical theatre productions of *Brigadoon* and *The Stingiest Man in Town* as well as several Cumberland Choral Society concerts and church Christmas programs. ... **Bob Lustig** is now in his fourth year at Cornell Medical College. ... While the first three years were not the most fantastic or stimulating, this year truly makes up for them. Electives in Dallas, San Francisco, and Seattle, plus traveling around on interviews for internship are making this year a kind of 'roads scholarship.'

Thanks to Ellen, we have news of her and **Cliff Grimes**. Since we last heard from them, Cliff has gotten his M.S. from Brown and is now employed by Schlumberger Well Services as a field engineer. They and their one year old son James Elliot now live in Pampa, Tex., near Amarillo. Concerning the locale, they write: "aside from being the only heathens and Patriots fans on our block (they're practically the same thing in Cowboy Country) we find it pretty nice. We may refuse to buy a pickup truck, wear cowboy boots or play Mel Tillis records on our stereo, but the natives have accepted us anyhow." How many other classmates are experiencing culture shock?

I apologize for not finishing all of the Telethon news I gathered in the last issue of *T.R.* So let me make up for my omission forthwith. **Gary** and **Jennifer Fostel** now have a daughter, Robin. Gary works for Intermetrics, which does a lot of work for NASA, building compilers, and Jennifer is doing bio research at the 'Tute. **Peter Galitzine** is taking a break from motorcycling this year and instead is doing some hunting, largely small game (deer) and birds. **Pete Okin** was in Boston for one month working at the Peter Brent Brigham Hospital. His wife, Lisa, (who is in her fourth year medical studies at Columbia) was simultaneously working at the Beth Israel Hospital. He saw **Peter Kaufman** for a few minutes, and reports that he is fine, plus that Ted Schiffren ('75) is now a math instructor at the 'Tute. **Larry Decklebaum** is interning at the Peter Brent Brigham and is now married. His wife, Lois, is a Simmons alumna. **Mike Scalli** is now in his fourth year at Harvard Med. **Bill Vagt** has 1½ years left to go at Lewis and Clark Law School. He spent last summer

working for Anaconda in Wyoming on a uranium reclamation project. Michelle and **Gary Buchwald** bought their first house, in Sharon, a lovely town near Milton, your secretary's hometown. **Ken Belsley** is in chemistry grad school at the University of Rochester. He is doing Laser-Raman studies in a group that does molecular dynamics. He informed me that **Gwen Champion** is at Johns Hopkins University. This wraps up the news I gathered at the telethon.

While in Manhattan on business just before these notes were due, I had the pleasure of seeing Nancy and **Mike Steckler**. They are both grad students at Columbia. Mike is still doing amazing work in origami on the side, when he is not being a geologist. Based on the collection in his apartment, I suggested to him that he leave geology and go into the origami business! We shall see.

And as for your secretary, he has been looking over the back columns he has done and is amazed at the number of people who have been covered. However, I still have some ways to go before I manage to cover our entire class. To help further in that effort, please write, whether it be about you or a fellow classmate. For you fans of the commodity markets, I am getting frightened by the astronomical heights being seen in the gold (\$850), silver (\$50), platinum (\$920) and palladium (\$268) markets. Many people have asked me where it will end. My answer remains — I do not know. In the interim, do not be short. — **Arthur J. Carp**, Secretary, Endymion Commodities, Inc., 131 State St., Suite 616, Boston, MA 02109

77

Hello, again, from the toilet paper capital of the world.

First of all, found a letter from **Steve Schiff** who writes, "I've been playing doctor at Duke medical school since graduation. I finished my required work for the M.D. and found I had a 'neuro fetish,' and so took electives in neurology and neurosurgery this summer and am now working towards a Ph.D. in neurophysiology. Life is enjoyable down here but it sure is different from Tech and Boston. Congratulations to **Erland** — a very well done movie with (of course) very good acting."

Next along the line is a fairly recent letter from **Tom Davidson**, who is still in the Cambridge area. He writes, "To all those who haven't seen or heard from me in a while, please send my greetings. I returned from six weeks of adventure, November 16, across the Atlantic, leading me to a narrow escape from the jaws of the Loch Ness Monster; my arrest in Holland for 'fietsig te nacht zonder de kaplampen'; and being stranded in Heathrow International until befriended by the U.S. Embassy and the wife of a Saudi Arabian banker. Fortunately, I'm once again safe and sound, back to my holistic life style in Cambridge, and avoiding the real world temporarily by taking on a commission study of the history of railroad signals before 1900 (please tell Bengt Muten, '77, that I'll send him a copy as he's a real railroad buff). On another note I feel that the class of '77 has inherently better cooks than the class of '78, and am considering challenging Earl Cohen, '78, for the title of 'World's Best Vegetarian Lasagna Cook.' All who visit Cambridge are invited to stop by 22 Fairmont Ave. for dinner to judge and/or make suggestions."

Next we hear from **Steve Gourley**, "I'm currently a second Lieutenant, U.S. Air Force, at Wright-Patterson Air Force Base, Ohio, in air to ground fire control, and working on the cruise missile guidance package for the Air Force Avionics Lab. Frequently travel to Boston and Washington, D.C., enjoying the free-of-school pressures and expenditures." He just finished a master's in aero and astro this past June to go with his bachelor's in the same field.

Steve Keith, also one of our members of the Armed Forces, says: "After finishing the Navy's nuclear power training program in August of '78, I flew across the Pacific to join the U.S. *Enterprise* for the end of her cruise in the Far East. After

returning with the 'Big E' to Alameda, I went to Surface Officers Warfare School in San Diego for four months; now I am back on the ship in the yards at Bremerton, Wash., for an overhaul which will last until September, 1980." I wonder how life on his 'Enterprise' differs from life on Captain Kirk's in *Star Trek*.

Peter Rosemark is "Still in grad school, U.C.L.A. medical physics program" Another one of our number in the Westwood area. As I recall, **Steve Spiro** is in medical school there, too.

"I'm working for Weather Services Corporation of Bedford, Mass.," writes **Todd Glickman**, "as an on-the-air meteorologist. I broadcast for 36 stations nation-wide, including WEEL in Boston and WCBS in New York." Hey, so all you people support a classmate and listen to the weather.

Next is a note from one of the many people in the Chicago area, **Tom Mills**. He says: "Plowing through medical school; now over half-way through my required clerkship at University of Illinois, Chicago Circle Campus. **Al Glombicki**, **Ira Pollack** and **Tim Hoops**, '76 are all mostly alive and well in my class. Sharing an apartment with **Steve Ray**, '73, who is working on a Ph.D. in environmental geology at the University of Illinois.

Finally, **Earl Bunker**, has been getting a lot of press around the country. He went into business buying and selling airline coupons put out by United and American Air Lines. Starting with \$20.13 in a checking account, he founded Merco, Inc. and began advertising. Figures indicate he was probably one of the largest dealers in the coupon trading business. He turned over 25,000 of the babies and started a futures market too. He optioned contracts for future coupon purchases, figuring to make a killing on them. Well, the market is all done now and he was closing down his operations as of December 4 and is currently interviewing and looking into marketing jobs in more established fields. Before he founded the company, he worked for Data General. If you would like some more information about his activities selling coupons, you can check out the articles in the *Wall Street Journal*, *New York Times*, *Boston Herald American* and any other major newspaper. He's been covered by them all. Not bad, Earl. Congratulations.

That wraps it up for this month. I'll accept any communiques, checks, veiled threats, and hope to be here in the next issue. Take care and please write. — **Doug McLeod**, Secretary, 1641 Smith St., Green Bay, WI 54302

78

It is once again my unfortunate duty to be the bearer of bad tidings. During my Thanksgiving trip to Cambridge I was informed that a classmate of ours, **Steve Kopelson**, died in Israel in November. Steve came to M.I.T. from New York City (Bronx High School of Science), and since his first days as a freshman was active in many student groups. He was probably best known as a frequent contributor (and editor, I believe) of *thursday*, a champion of rock trivia and of fencing bouts, a fine graphic artist and an activist. During his time at M.I.T. he was strongly committed to and active in organizations for student rights, civil rights and gay rights. An ardent Zionist, he spent his last months working as an architect on a kibbutz in Israel. He was a friend of mine since our freshman year, a willing opponent in friendly debate, and a colleague in community affairs. He will be sorely missed by those of us who counted ourselves among his friends.

News: I received several interesting notes from classmates, a couple from people who aren't sure whether or not they're classmates and a couple of other bizarre tidbits. I'll start with our medical personnel. **Dan Rahman** writes from the New York Medical College in upper Westchester County where he is in his second year, and notes that he has joined the Westchester Educational Council. ... **Barry J. Londer** got his M.S. in Biological Engineering at U. Conn. and has returned to Boston to work as a Biomedical Engineer in the Neurology Department at Peter Bent Brigham Hospital. After that he hopes to attend medical

school. ... **Diane R. Prignoli** writes that she is working in tumor immunology at the Lenox Hill Hospital in New York City.

And last among our fearless folks in white coats is a somewhat frightened **Lloyd Benjamin** at the University of Texas Medical School at Houston. I quote at length: "Look, no matter what I may have said a year ago about this medical school being dull, I take it all back. After a year and a half, we still haven't seen hell or highwater of a hospital and they flunked the heck out of our class, about 10 per cent, so things have really been hoppin! For fear of becoming too isolated in the medical profession, I decided to join the joint M.D./R.N. degree program, which has been kinda kinky. The white stockings and dress and corrective shoes are a gas." Lloyd also reports some gossip from the coasts: "I understand that **Ned Kaufman** of Philly has dyed his hair green and does the Pogo to class every day. ... As for **John Troiana**, in Los Angeles, he's supposedly become so mellow, he just levitates to work every day. Like wow!" Thanks for the gossip Lloyd, and I hope that these two former friends of yours are understanding.

Ray Swartz writes from Boston that he is working as an energy conservation analyst with the Mass. Office of Energy Resources, training people to do energy audits of commercial buildings. (Coincidentally, Ray, I had a small part in an early design of that program.) Another note from Beantown came from **Paul Lagace**, who is moving rapidly towards the completion of his Ph.D. in Aero/Astro Engineering. Paul also notes that he was a member of one of the committees involved in seeking out a new Institute president, and feels very happy and confident about the eventual choice, Paul Gray.

A computerized Christmas card came from **Rob Milne** in Edinburgh, Scotland. Rob is working on his Ph.D. in artificial intelligence at the university there. He recently received a "studentship" from the university (sounds like a fancy fellowship to me) and has been reelected president of the Post-Graduate Student Union. Of late he has been climbing in the Alps and in the mountains of Scotland, as well as playing some rugby, doing A.I. research and taking some classes — that is, I think he is taking some classes.

Most of the rest of the notes I have received have some measure of confusion. Take **Nancy Greenberg**, for example. Nancy is not sure exactly what class she is in, so she wrote to me with her news. She transferred into the class of '77 but she graduated in February '78 — I guess that makes her class of '78. Nancy is working for Proctor and Gamble in Cincinnati doing regulatory compliance with the Food, Paper, and Coffee Technology Division. In her spare time she is learning to play racketball and taking a course in gourmet cooking and swimming competitively.

More Class confusion: **Tapio Kuusinen**, who got both the S.B. and S.M. in '79 would like to be in the class of '78. We would be honored to have you, Tap, but it's not that easy. The way to change your class listing is to send a letter to Fran Chandler in M.I.T. Room 12-087A and give her the info. Since Tapio is officially in the class of '79 I'm not supposed to report that he is working in environmental technology research and development for Weyerhaeuser in Seattle ... but I'm sure the secretary of '79 will forgive me.

And then there is **Thomas D. Y. Chung**, who knows what class he's in, but doesn't know who his secretary is. Tom wrote a letter to the class of '79 secretary in order to correct some details about what I wrote about him a few issues ago. After leaving M.I.T. Tom started on a Ph.D. program in Chem. at Stanford. He is now taking a short break from school, working at Exxon in New Jersey, doing microbiology for the biosciences group. After this year he will be returning to Cambridge to continue working on his doctorate, but this time at Harvard (because his Stanford advisor recently moved there).

My only note from California — what's the matter you guys, can't you take a joke? — comes from **Gary Cote** who writes: "If **Dave Brown** (sic) sees this tell him I'm going for a Ph.D., not as he seems to think, an M.S. I can't be insulted. The San Diego Alumni Club just got it straight that I'm

a grad student, not a research assistant!" My apologies Gary; I never claimed to be accurate — just voluminous.

And last and least, a cryptic note from **Dick Field** which reads: "To **Nino Pedrelli** in Ohio, 'How's it for Hogans?' Am finishing up my master's at ZooMass. 'Blome to NRSA'." If anyone can think of a coherent translation please let me know.

Your secretary writes from the midsts of finals week here at the University of Michigan Law School, being buried by Evidence and suffering from an irrepressible desire to reread the *Lord of the Rings*. The life of a second year law student is ruff. My deepest apologies for missing a column in the November issue; I seem to remember writing one, but it was never received by the editors. ... If anyone out there has sent me news that seems to have been forgotten or lost — like my whole November column — please send me another note. For now, I must return to my books (Frodo and Sam are approaching Mount Doom) and prepare for my own battles against the forces of evil and doom — final exams. *A Elbeth!* **Gilthoniell** — **David S. Browne**, Secretary/Treasurer, 1026 Vaughn St. No. 6, Ann Arbor, MI 48104 (313) 995-9806

79

Hi there! Lots of news this month; much of it thanks to **Nivin Pel** and **Brenda Pomerance**, who proved to be very good spies at Nivin's wine and cheese bash last Thanksgiving! Nivin spent the first part of the summer touring China and Greece, then returned to M.I.T. to finish a lab project, which she completed in September. She's now living in an apartment in New York's Upper East Side, and last I heard was planning to begin working after the New Year. Brenda is working for Computer Sciences Corp. in Falls Church, Va., a suburb of D.C., and recently purchased a condominium in D.C., not suburbia. "Suburbia is so yucky!!!" Brenda is also studying information theory and communication theory at George Washington University. She would love to have people write to her or visit if they're in the vicinity. (Her address: 2201 L St. No. 709, Washington, D.C. 20037) ... **Cindy Cole** is also working for Computer Sciences Corp., but in the Munson Hill branch (another D.C. suburb). She lives in Arlington, Va., with Katrina Wootton ('77).

Some of the dirt that Nivin and Brenda dug up: **Jeffrey Dugal** is working for the Ball Corporation in Muncie, Ind., designing a new plastic ketchup bottle for Heinz! Jeff is taking management courses at Ball State University and was also taking Judo until he tore some cartilage in his knee. ... **John Chang** is still at M.I.T. working on a masters in electrical engineering. ... **Michael Brzustowicz** is doing graduate work in physics at Carnegie-Mellon University. He thinks Pittsburgh is "the Pits" and has decided that the apathy at C.M.U. is "even worse than at M.I.T." ... **Tze-Kong Meng** is living at home in New Rochelle, N.Y., and is studying medicine at Albert Einstein Medical College in the Bronx. ... **William Engelhardt** is in Cambridge working as a security guard in one of the apartment buildings down by the wharf. He's still ringing with the M.I.T. Bell Ringers.

This month's prize for the most unusual and creative occupation goes to **Claude von Roengen**, who reports, "Since graduating in June I started selling 'NO GAS MY ASS' tee shirts in gas lines. I sold the business in August and since then have been successfully dabbling in the oil market!!!"

It saddens me very much to report the death of classmate **Stephen Kopelson**. Originally a member of the Class of '78, Stephen graduated with degrees in Architecture and Urban Planning. While at M.I.T., he was the staff and eventually editor of *thursday*, and was a member and manager of the fencing team.

I hope next month will bring good news from everybody. I'm still waiting to hear from some of you — and you know who you are! — **Sharon Lowenheim**, Secretary, 3600 Chestnut St., Box 1166, Philadelphia, PA 19104

1980 ANNUAL BALLOT

See the next
page for
Candidate
Profiles

This ballot is
to elect 3
new members
to the
National
Selection
Committee for
three year
terms.

Ballots must be
returned by
May 23
to be counted

The National
Selection
Committee's
task is to
select officers
of the MIT
Alumni Assoc-
iation:

The President
1 year term

**4 Vice
Presidents**
alternating 2
year terms

9 Directors
from the 9
electoral
districts
alternating
2 year terms

And to nomi-
nate 3 alumni
each year to
serve for 5 year
terms on
the MIT
Corporation.

Candidates
have been
nominated by
MIT clubs in
the three dis-
tricts in which
vacancies
occur this
year.

Each alumnus/a
should vote
for one candi-
date from each
district.

1 Election of Members of the National Selection Committee 3 year term

Vote for *one* in each district

District 3:
New York State (except
New York City and
Long Island), Connecti-
cut, Rhode Island,
Ontario

- ☐ Bruce F. Becker '70
- ☐ Edward D. Kane '47
- ☐ Peter Sexton '65

District 8:
Minnesota, Iowa,
Missouri, Arkansas,
Louisiana, North
Dakota, South Dakota,
Nebraska, Kansas,
Oklahoma, Texas,
Montana, Wyoming,
Colorado, New Mexico,
Manitoba, Saskatche-
wan, Alberta, Mexico,
Central America, Canal
Zone, Panama

- ☐ John J. Casey '40
- ☐ Gordon W. Moore '60
- ☐ Robert L. Rorschach '43

District 9:
Utah, Arizona, Idaho,
Nevada, Washington,
Oregon, California,
Hawaii, Alaska, British
Columbia, Yukon, NW
Territory, Philippines

- ☐ Robert L. Blumberg '64
- ☐ H. Dubose Montgomery '71
- ☐ Harold H. Strauss '38

Vote by mailing
this ballot
by May 23 to:
MIT Alumni
Association RM 10-110
MIT
Cambridge, MA 02139

2 Suggestions for future officers All suggestions will be transmitted to the National Selection Committee for their consideration.

President

Vice President

Board of Directors

**Alumni Nominees
to the
MIT Corporation**

Profiles of
Candidates
for
Membership
on the
National
Selection
Committee

Vote for
one
in each
district
by
using the
ballot
on the
preceding
page.

District 3 ▼



Becker '70

District 8 ▼



Casey '40



Kane '47

District 9 ▼



Blumberg '64



Moore '60



Sexton '65



Montgomery '71



Rorschach '43



Strauss '38

District 3

Bruce F. Becker '70
Sloan School of
Management
Pittsford, NY
Assistant Comptroller,
Kodak Park Division
Eastman Kodak Com-
pany
Personal Solicitation
Campaign 1979. Special
Gifts Chairman 1977-
78. MIT Leadership
Campaign 1975. MIT
Club of Rochester, NY:
Director 1972-; Presi-
dent 1979. Sloan
Fellow MIT 1970.
Member Board of
Directors Valley Manor
Association. Regional
Health Planning
Council.

Edward D. Kane '47
Chemical Engineering
Windsor, CT
Director, Planning &
Business Development
Power Systems Group
Combustion Engineer-
ing, Inc.
MIT Personal Solicita-
tion Program 1978-79.
Telethon Solicitation
1969-. Special Gifts
Solicitation 1963.
Alumni Fund Local

Chairman 1961-63.
MIT Club Niagara Falls,
NY: Secretary 1948-50.
MIT Club of Hartford,
CT: Director 1967-;
President 1955-58;
Secretary 1951-54.
Director, Greater Hart-
ford Unit American
Cancer Society. Board
of Governors, Cliffs-
side Country Club, Sims-
bury, CT.

Peter Sexton '65
Metallurgy
Weston, CT
Manager, Industrial
Products Division
Handy & Harman
MIT Alumni Center of
New York: Executive
Committee 1978-.
Educational Council
1979-. MIT Club of
Northern New Jersey:
Board of Governors
1975-77; Treasurer
1976-77. MIT Club of
Fairfield County:
Board of Directors
1977-; President 1978-
79; VP Membership
1979-; VP Programs
1977-78. Member:
AIME; ASTM; IPMI;
ASM.

District 8

John J. Casey '40
Civil Engineering
Carrollton, TX
Group Vice President
Vice Chairman of the
Board
Braniff International
MIT Corporation Lead-
ership Award 1977.
Second Century Fund
Region 5: Chairman for
Nassau County, NY
1961-63. Class of 1940
Reunion Committee.
Member MIT Alumni
Center of New York.
Member: Society of
Automotive Engineers;
American Institute of
Aeronautics and Astro-
nautics; Wings Club,
New York; Air Force
Association; National
Defense Transportation
Association; 509th
Composite Bomb
Group Association.
Silver Beaver Award,
Boy Scouts of America
1967. Current Presi-
dent, Area II, South
Central Region, BSA.
Circle Ten Council,
BSA: Past President;
Currently Vice Presi-
dent-Finance. Member
Board of Directors,
Dallas United Way.
Member Advisory
Council School of Man-
agement and Adminis-
tration, U of Texas at
Dallas. Director, Texas
American Bank of
Dallas. Past Rear Com-
modore, Dallas Corin-
thian Yacht Club. Mem-
ber: Chandlers Landing
Yacht Club; North-
wood Club Dallas.

Gordon W. Moore '60
Sloan School of
Management
Denver, CO
Vice President
Midwest Data Systems,
Inc.
MIT Educational Coun-
cil 1973-. Alumni
Activities Board: Chair-
man 1979-80; Member
1977-80. MIT Leader-
ship Campaign: District
Officer 1978; Solicitor
1977-80. MIT Alumni
of Colorado: President
1974-77; Vice President
1973-74, 1978-. MIT
Club of San Francisco:
Vice President 1971-72.
Director, Colorado
State Science Fair 1978.

Robert L. Rorschach '43
Chemical Engineering
Tulsa, OK
Consulting Chemical
Engineer
President:
Process Technology
Corp.
Colonial Royalties Co.
Alumni Association
Board of Directors,
District 8, 1973-75. MIT
Educational Council
1960-; Regional Chair-
man 1978-. Alumni Ad-
visory Council 1973-75.
Club Advisory Board
1972-75. Alumni Fund:
Regional Gifts Solicitor
1975-78; Regional Vice
Chairman 1972-74.
Class of 1943, Vice-
President 1973-78. MIT
Club of Oklahoma:
Director 1968-77;
President 1971-72.
Member: AIChE; ACS;
AIME-SPE; NSPE.
Tulsa City-County En-
vironmental Advisory
Council: Member 1967-;
Chairman 1967-78.

District 9

Robert L. Blumberg '64
Chemical Engineering
San Diego, CA
Partner
Idanta Partners, Ven-
ture Capital Investments
MIT Educational Coun-
cil, San Diego 1977-.
Regional Gifts Chair-
man, San Diego 1975-
76. Class of 1964: Vice
President 1969-74.
Director: American
National Bank (CT);
Cott Holding Corpora-
tion. Chairman of the
Board, Western Yarns,
Inc. Vice President,
Western Venture Cap-
ital Association 1978-
79. California Youth
Soccer Coach 1978-.

H. DuBose Montgomery '71
Electrical Engineering
and Sloan School of
Management
Hillsborough, CA
Managing Director
Menlo Financial
Corporation

Alumni Activities
Board 1979-; Chairman
Program Growth and
Self-Sufficiency Sub-
committee 1979-.
Alumni Fund: Advisory
Committee, Personal
Solicitation Campaign
(San Francisco) 1979-;
Regional Gifts Solicita-
tion 1976-78; Volun-
teer Solicitor 1979-.
MIT Club of Northern
California: Board of
Directors 1977-; Presi-
dent 1977-79; Vice
President 1975-77.
Member: IEEE; Tau
Beta Pi; Eta Kappa Nu;
Sigma Xi; American
Electronics Association;
National Association of
Small Business Invest-
ment Companies. Board
of Directors: Data Elec-
tronics, Inc.; Waugh
Controls Corp; Menlo
Financial Corporation;
Kirk Knight & Co., Inc.
NSF Fellow. Scott
Paper Foundation Stu-
dent Leadership Award,
MIT. Fund Raiser: Chil-
dren's Health Council
(Palo Alto).

Harold H. Strauss '38
Mechanical-Electrical
Engineering
Santa Monica, CA
Consulting Mechanical/
Energy
Professional Engineer
Bronze Beaver Award
1976. Alumni Council
Life Member. Alumni
Association Board of
Directors, Region 9,
1977-79. MIT Educa-
tional Council: 1962-;
Regional Chairman to
1976. MIT Leadership
Campaign 1975-80.
Class of 1938 Assistant
Secretary. Second Cen-
tury Fund Regional
Vice Chairman 1961-63.
Alumni Fund Area
Council Chairman
1968-69. Alumni Fund
Special Gifts: Chairman
1965-67; Area Chair-
man 1966. MIT Club of
Southern California;
Lifetime Governor;
Member 1938-39, 1942-
47, 1948-. MIT Club of
St. Louis 1947-48. MIT
Club of Buffalo 1939-
42. Fellow, Institute
for the Advancement of
Engineering. Associate
Fellow, American Insti-
tute of Aeronautics and
Astronautics. National
Society of Professional
Engineers, Director
1968-71. National
Council of Engineering
Examiners, 1961-69.
California Society of
Professional Engineers,
President 1967-68. Cali-
fornia State Board of
Registration for Profes-
sional Engineers; Mem-
ber 1961-68; President
1965-66. Symphony
Orchestra Committee
1973 Presidential Cita-
tion. Ionic Lodge #520
F. & A.M., Master 1964.

People



To Professor Victor F. Weisskopf from President Jimmy Carter: the National Medal of Science, the highest honor accorded U.S. scientists and engineers by the U.S. government. Professor Weisskopf was honored for his theoretical work in quantum electrodynamics and in nuclear and particle physics. (Photo: Wide World)

Medals of Science

Three members of the M.I.T. community, including **Victor F. Weisskopf**, Institute Professor Emeritus and professor of physics emeritus, were among 20 U.S. scientists and engineers awarded the National Medal of Science in Washington on January 14. It was a gala occasion — a White House mid-morning ceremony preceded by a dinner honoring present and previous medalists and White House science advisers.

In addition to Professor Weisskopf, honors were given to:

□ **Richard P. Feynman**, '39, professor of physics at California Institute of Technology, for his explanation of the behavior of subnuclear particles.

□ **Robert N. Noyce**, Ph.D. '53, chairman of Intel Corp., for his work on semiconductor devices for integrated circuits.

Professor Weisskopf was cited for his achievements in particle physics and contributions to understanding nuclear reactions. He is one of the Institute's most honored faculty members, widely respected in Europe as well as in the U.S. He was head of the Physics Department for eight years ending with his retirement in 1973, and from 1960 to 1965 he was director general of the European Center for Nuclear Research (CERN), on leave from M.I.T.

Shirley McBay: Mathematician-Teacher for the Dean's Office

A year-long search has ended with the appointment of Shirley M. McBay, a mathematician-administrator who is now program director in the Science Education Directorate of the National Science Foundation, to be dean for student affairs at M.I.T.

Dr. McBay succeeds Dr. Carola Eisenberg, who left the Institute in September, 1978; throughout the interim period, Profes-



Shirley M. McBay, who has "a distinguished academic and administrative record in the sciences" (President Jerome B. Wiesner's words) will leave the National Science Foundation in April to become dean for student affairs at M.I.T.

sor Robert L. Halfman, '44, has been in charge of the office. Dr. McBay will come to M.I.T. during April.

Before joining the National Science Foundation in 1975, Dr. McBay was professor of mathematics, department head, and associate academic dean at Spelman College in Atlanta. She studied at Paine College, Augusta (B.A. 1954), Atlanta University (M.A. mathematics and physics 1955), and the University of Georgia (Ph.D. mathematics 1966) and served for 20 years on the staff and faculty at Spelman College.

At the NSF, Dr. McBay has directed two national programs to increase the participation of minority students in science and engineering for which she has received a number of commendations. Earlier, at Spelman, she had been responsible for strengthening the science curriculum, faculty and facilities, and the success of that effort stimulated a reorganization of the college's entire academic program.

Paul E. Gray, '54, chancellor, called Dr. McBay "a superb match" for the dean's office: "She has a rare combination of academic and managerial experience, extraordinary energy, capacity for hard work, wisdom, warmth, and forthrightness which have impressed all who have worked with her."

Constantine B. Simonides, '57, vice president who led the search effort, admitted that Dr. McBay had been hard to convince. "But visiting M.I.T. and meeting the people here had a decisive influence on her decision," he said.

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Given A. Brewer '38
Leon J. Weymouth '48
Stanley A. Wulf '65
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F. Eugene Davis IV

M.I.T. '55 S.B. Physics
Harvard Law School '58 L.L.B.

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Transducer Design
Vibration Analysis

Robert D. Bruce '66
50C Moulton St., Cambridge, MA 02138
(617) 491-1850



A celebration of M.I.T. alumnae. The entrance to Buildings 2 and 4 from the Killian Court is now the Ellen Swallow Richards (1873) Lobby, named in honor of the first woman to graduate at M.I.T., and a plaque, portrait, and other memorabilia of Mrs. Richards are now on display there. Three prominent alumnae spoke at a short naming ceremony early this year: Susan Schur, '60 (left), on Mrs. Richards' pioneering contributions to public health and ecology; Florence Luscomb, '09, with some personal recollections of Mrs. Richards' role in the Institute; and Marjorie Pierce, '22 (right), on the influence of Mrs. Richards on the role of women at the Institute. (Photo: Calvin Campbell)

With the Alumnae

Time passes . . . Florence Luscomb '09, M.I.T.'s oldest living alumna is also the only alumna who actually knew A.M.I.T.A.'s founder, Ellen Swallow Richards, 1873. Ms. Luscomb was therefore the opening speaker on January 10 when the lobby of the intersection of Buildings 2 and 4 was officially dedicated as the Ellen Swallow Richards Lobby. This dedication, in conjunction with a recently funded Ellen Swallow Richards Chair (a long term A.M.I.T.A. project) marks, at long last, official, Institute-wide recognition of one of the most remarkable people, male or female, ever to attend M.I.T.

Ms. Richards was the founder of home economics, and of the science of ecology (a term which she coined), founding member of the AAUW, the Women's Social and Industrial Union, and the Boston Women's Kitchen (where working women could pick up complete nutritionally balanced meals on their way home from work), and a member of other important scientific and feminist organizations.

These accomplishments were among those enumerated by Ms. Luscomb, and the other dedication speakers, Marjorie Pierce '22, and Susan Schur '60. Ms. Schur read some quotes of Ellen Swallow Richards which were so current in their concerns that they could have been said today. She tackled such subjects as nutritional lacks in the American diet, the need for the protection of



J. S. Collins



L. E. Milan



C. D. Seligson



B. Hambleton

clean air and water, the intellectual equality of women, and the ability of technology, properly applied, to improve everyday life.

The exhibit is not merely a catalogue of Ms. Richards' numerous outstanding accomplishments — it portrays the warm, concerned woman, who as Florence Luscomb said, "always came to our parties, and always had the time for us . . . She was not officially the Dean of Women, but she acted as such. She listened to our problems and was warm and encouraging."

When you're next at M.I.T., stop and see the newly decorated lobby and get to know Ellen Swallow Richards for yourself. — Dianne Germany

Collins, Milan, and Seligson Take New Alumni Assignments

Three major appointments made early this winter gave the Alumni Association staff a stable start for the 1980s:

□ Joseph S. Collins, formerly midwest regional director, is now the director of the Alumni Fund, the main financial link between the Institute and its 70,000 alumni.

□ Lawrence E. Milan, a personnel officer at M.I.T. since 1978, has become regional director for the midwest.

□ Carol D. Seligson, '71, has returned to M.I.T. from Baltimore, Md., to be regional director for the southeast.

Mr. Collins first came to M.I.T. in 1969 to join the office of the chairman of the Corporation following a career in the U.S. Navy; he graduated from the Naval Academy in 1963. After taking a variety of roles in M.I.T.'s community relations activities, Mr. Collins came to the Alumni Association in 1976.

When he announced Mr. Collins' new appointment, James A. Hester, '65, executive vice president of the Alumni Association, rejoined in his "solid background of experience at M.I.T. and . . . his strong belief in the objectives of the Alumni Fund." It was Thomas H. Farquhar, '60, former chairman of the Alumni Fund Board, who headed a nationwide search to fill the Alumni Fund post, vacated with the resignation last summer of Stephen P. Denker, '59. It's a big job: the Alumni Fund annually brings to the

Institute over \$5 million in gifts from over 22,000 alumni, and both figures are programmed to rise sharply in coming years.

Mr. Milan was educated in English, health, and physical education at Bluffton College, Ohio; and he holds a master's degree in high education and administration from Michigan State University (1975). Before coming to M.I.T. he worked in student and personnel affairs at the State University of New York at Oswego; he counts his career there and in the M.I.T. Personnel Office as a crucial learning experience for a "roving ambassador" working in the field with alumni.

Ms. Seligson was employed independently as a financial consultant in Baltimore, where she was active in the M.I.T. Club of Maryland. She originally went to Baltimore to be a graduate fellow in economic and technological history at Johns Hopkins University in 1974-75.

Brenda L. Hambleton, '79, who worked part-time for the Alumni Fund last year as an undergraduate, has now joined the fund staff as coordinator of special programs. She's providing central support for the telethon activities planned for 1979-80 and for other special activities as they develop.

Ms. Hambleton's undergraduate degree was in chemistry; she was advertising manager of *The Tech* during her senior year.

Philip L. Alger, 1894-1979

Philip L. Alger, '15, who had a distinguished 40-year career with General Electric Co. and then went on to ten years of teaching in the Electrical Engineering Department at Rensselaer Polytechnic Institute, died on September 24 in Schenectady, N.Y., after a long illness; he was 85.

Mr. Alger held teaching and research assignments at M.I.T. for two years after receiving his S.B. in electrical engineering; he joined General Electric in 1919 after a brief period of military service and became a leading contributor in electric motor design. Among other honors, he held the Lamme Medal (1959) of the Institute of Electrical and Electronics Engineers and an honorary doctor of engineering from the University of Colorado (1968).

Courses

Civil Engineering

Peter S. Eagleson, Sc.D.'56, professor of civil engineering at M.I.T., has been presented with the Robert E. Horton Award of the American Geophysical Union, for outstanding contributions to the field of hydrology. . . . **Mark A. Turnquist**, Ph.D.'75, has joined the Cornell University faculty as associate professor in civil and environmental engineering. . . . **Charles C. Noble**, S.M.'48, executive vice president of Chas. T. Main, Inc., Boston, Mass., has been presented with a certificate and pin, signifying his membership in the American Consulting Engineering Council, a federation of 49 state and regional associations of private practice consulting engineering firms.

Robert S. Broughton, S.M.'59, reports that he is on sabbatical leave from McGill University this year; and some of his research time will be devoted to development work in drainage and irrigation engineering in Trinidad and El Salvador. . . . **Thomas S. Maddock**, S.M.'51, president of Boyle Engineering Corp., reports that Boyle has international engineering assignments in progress on two major regional water supply projects in the Dominican Republic and Jordan. . . . **Peter K. Kitandis**, Ph.D.'78, assistant professor at the Iowa Institute of Hydraulic Research, was awarded the 1978 L.G. Straub Award for the best doctoral dissertation in hydraulic engineering.

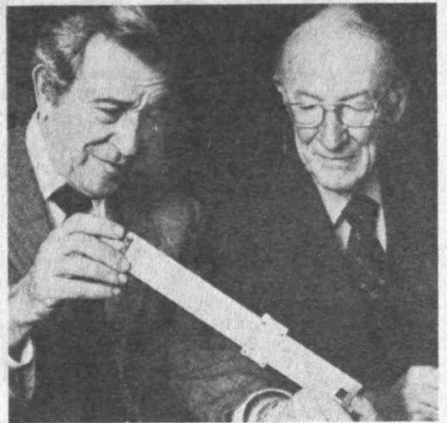


Charles C. Noble

Siegfried M. Breuning, Sc.D.'57, a transportation expert in the department of civil engineering at Southeastern Massachusetts University, was contest coordinator for a competition involving the best working prototype of a human-powered, second car. . . . **Raymond V. McGrath**, S.M.'36, reports that he is "enjoying beautiful summers at Black Butte Ranch in Oregon." . . . **Rebecca A. Crane**, S.M.'79, reports her marriage to Dan Matthias, president of QYA, Division of Exxon, on January 26, 1980.

John Lowe III, S.M.'37, notes, "On November 18, 1978, I delivered the Fourth Nabor Carrillo lecture, entitled "Foundation Design-Tarbela Dam." The lecture was sponsored by the Sociedad Mexicana de Mecanica de Suelos. . . . **Richard R. Pikul**, S.M.'67, completed a doctor of engineering degree at R.P.I. in August, 1979. Presently he is professor of civil engineering at Union College, Schenectady, N.Y., and is also providing struc-

Starting a new collection of M.I.T. "slip-sticks." **Kenneth J. Germeshausen**, '31, shows **President Jerome B. Wiesner** (right) one of two slide rules which he's given to M.I.T. Historical Collections. **Warren A. Seamans**, director, wants them to become the cornerstone of a comprehensive collection and urges alumni to send in the instruments now displaced by electronics. (Photo: Calvin Campbell)



Gathering Slip-Sticks Before they Slip Away

The "slip-stick" hanging from the belt loop, once the trade mark of every M.I.T. student, has given away to technological progress, and within a short decade slide rules are suddenly objects of the past instead of the present and the future.

Thinking thus led **Warren A. Seamans**, director of M.I.T.'s Historical Collections, to realize that a priceless opportunity may be slipping away: before it's too late, he wants to make "a definitive collection" of slide rules of M.I.T.

"No instrument is more associated with M.I.T., at least in the minds of alumni," he says. Yet Historical Collections today contains no more than a dozen examples, including two antique cylindrical calculators. Mr. Seamans hopes that many members of the community, including alumni, will contribute their slide rules, now instant antiques — and tax deductible — toward a comprehensive collection.

Thomas C. Tlearny, Jr., Ph.D.'78, reports that he is presently on a one-to-two year special assignment at Argonne National Laboratory's Material Science Division performing studies on the effects of coal gasification environments on structural metallic components within the refractory lining. . . . **Robert T. Howard**, Sc.D.'42, reports "Hooray! Our last child has finished at the University of Vermont. The Howard family can now cease driving the Cadillac off a cliff each year. Jack is the recent graduate; Angelika is working as a research chemist at Dow Corning Co.; and Tom was married in Alabama last summer."

V

Chemistry

Charles A. Merritt, Jr., Ph.D.'53, a supervisory analytical chemist in Swampscott, Mass., has been presented the Department of the Army's Research and Development Achievement Award for his leadership in pioneering research on the effects of radiation chemistry in food and food components. . . . **Michael A. Kay**, Sc.D.'70, is currently a senior scientist in the Environmental Analysis and Monitoring Department at Rockwell Hanford Operations, working on the long-term transuranic defense waste management program. . . . **Howard S. Corey, Jr.**, Ph.D.'55, is president-elect of the Drug Information Association, an international organization of academic,

tural engineering consulting services to design and legal professionals as **Richard R. Pikul**, P.E.

Louis J. Capozzoli, Sc.D.'50, is entering his fifteenth year as president of L.J. Capozzoli and Associates, a geotechnical engineering firm, Baton Rouge, La. Recently he was awarded the Technological Award from the Louisiana Engineering Society for his work in supporting storage banks on soft clay, using a controlled loading procedure. . . . **Marten Henriske**, S.M.'66, of Koninginneduinweg, The Netherlands, died on November 9, 1979. . . . **Susan Marie Wuennenberg**, S.M., was married to William Garretson Atkinson III on July 28, 1979, in St. Louis, Mo.

II

Mechanical Engineering

Paul F. Pilger, S.M.'74, notes that he has been promoted to supervisor, Utilities Unit, Northern Area Operations Engineering, Aramco at the Saudi Arabian oil shipping port of Ras Tanura. . . . **James R. Meginnis**, S.M.'70, is currently assistant professor of economics at Claremont Graduate School and assistant professor of humanities and social sciences at Harvey Mudd College. . . . **Michael A. Feldstein**, S.M.'66, has been promoted to director of mass storage engineering at Data General Corp., Westboro, Mass. This design engineering group is responsible for the development of all magnetic disc and tape memories offered by Data General.

Daniel M. Hancock, S.M.'73, has been named a supervisor of product engineering in the Military Transmission Engineering Department at Detroit Diesel Allison Division of General Motors, Indianapolis, Ind. . . . **Pierre P. Dogan**, Ph.D.'67, has been named to the newly created position of program manager for the MACSYM impact team of Analog Devices' Measurement and Control Products Division.

Barry Lubin, '65, has been appointed to serve on the staff of a congressional committee for a one-year term; participating in the lawmaking process while contributing engineering expertise. . . . **James A. Levins**, S.M.'57, senior vice president of MPB Corp., has been elected to the Monadnock United Way board of directors.

III

Materials Science and Engineering

Morris Cohen, Sc.D.'33, professor of materials science and engineering at M.I.T., has been awarded an honorary doctorate degree from The Technion — Israel Institute of Technology, "in recognition of his research achievements in the fields of metallurgy and materials science and his contributions to the education of materials engineers for industry." . . . **Albert E. Palandino**, Sc.D.'62, has joined the National Bureau of Standards, National Engineering Laboratory as deputy director, Office of Energy Programs.



You Need "Sun Rights" to Guarantee Your "Solar Envelope"

You're heating hot water with solar energy. Then your neighbor adds to his house and shuts off three hours of sun from your solar collector. Without "sun rights" you have no recourse, and almost nobody has "sun rights" these days.

Ralph L. Knowles, M.Arch. '59, university professor of architecture at the University of Southern California, may have in progress the only solar-access design research project in the U.S. today. From it has come the concept of a "solar envelope" — an angular volume (imaginary) which somewhat resembles a tent. It is that volume which sits over any property owner's land which he can occupy without interfering with his neighbor's access to the sun.

In his research on energy-efficient architecture funded by the National Endowment for the Arts, Professor Knowles is now developing a set of zoning regulations based on the notion of a "solar envelope." It's a simple idea — everyone wants to protect his petunia patch from his neighbor's shade. But when it comes to solar energy, big investments and large stakes in energy conservation mean there are "very important reasons for guaranteeing solar access," says Professor Knowles.

It even happened to him. Professor Knowles lives in Silverlake, Calif., where a three-story house was recently built next door in a way that blocks his southern light. "It's like a doctor who goes into medicine because he thinks he's going to die," he says philosophically.

governmental and industrial specialists in the gathering, analyzing, summarizing, storing, retrieving and use of drug-related data.

Arnet L. Powell, '52, reports that he retired from federal employment on October 1, 1979 — after 32 years of service, 20 of which were as director for science, Office of Naval Research, Boston, Mass. He plans to remain active by serving as a consultant in research and development. . . . **William S. Benedict**, Ph.D.'33, an authority on spectroscopy and a professor emeritus at the University of Maryland, died on January 10, 1980. He was considered a specialist on the spectrum of water vapor as well as a leader in the interpretation of the spectra of solar and planetary atmospheres.

VI

Electrical Engineering and Computer Science

Two promotions have been made in the top management positions of MITRE's Bedford, Mass., operations technical division: **Kenneth E. McVicar**, S.M.'50, to vice president and general manager of the C3 division . . . and **Roy W. Jacobus**, '59, to technical director of D-80 aerospace surveillance and defense. . . . **Allen W. Luniewski**, S.M.'77, reports that he has completed his Ph.D. program in the department and has joined the Xerox Corp., Palo Alto, Calif.

Samuel E. Estes, S.M.'58, formerly of Ridgefield, Conn., died in October, 1977. . . . **Mark A. Orenstein**, S.M.'68, has been appointed associate director in the data processing department at the Travelers Insurance Companies in Hartford, Conn. . . . **Arthur J. Schneider**, Ph.D.'59, has been named staff vice president of the Sperry Research Center, Sudbury, Mass.

William J. Mitchell, S.M.'68, is supervisor of the group at Bell Labs, North Andover, Mass., working on the digital master group. . . . **Elerly F. Buckley**, Sc.D.'49, is presently chief electronic engineer at Emerson and Cuming Co., Canton, Mass. . . . **P. Gene Smith**, S.M.'51, has been awarded a congressional fellowship for 1980 by IEEE. He will spend the calendar year of 1980 as a full-time professional staff member for a U.S. Senator, a Representative, or a Congressional Committee. . . . **Hans P. Geerning**, Ph.D.'71, is presently associate professor in measurement and control in the Department of Mechanical Engineering of the Swiss Federal Institute of Technology, Zurich.

Randall A. Stern, S.M.'73, has been appointed vice president for software development at Kurzweil Computer Products, Inc., Cambridge,

A flashy reunion.

It was in the early 1930s that Gjon Mili, '27, then studying lighting for motion picture photography at Westinghouse, encountered Professor Harold E. Edgerton, Sc.D. '31, and the latter's high-speed strobe lights. The response was immediate: "How can I get a set of these new lamps?" When Gjon promised to quit his Westinghouse job and set up the country's first studio with strobe lights, "Doc" Edgerton's response was immediate, and the self-portrait at the left is one of the early results of that collaboration. This fall a retrospective of Mr. Mili's many strobe-lighted photographs has occupied the Margaret Hutchinson Compton Gallery in the M.I.T. Alumni Center, and late in October Mr. Mili finally tore himself away from the task of writing memoirs to receive the plaudits of his many Cambridge friends. Among those present (left to right): Frank Massa, '27; Mr. Mili, Professor Edgerton, and Kenneth J. Germeshausen, '31. (Photo right: Edward J. Alshut)

Mass. . . . **Robert Pinto**, S.M.'69, reports, "My wife Claire has recently given birth to our first child, Daryl Brett. I am presently working at TASX, Inc., Reading, Mass. I would really enjoy hearing from any of my former classmates or fraternity brothers." . . . **Leonard Kleinrock**, Ph.D.'59, is professor of computer science at U.C.L.A., is a recognized world authority on computer networks, and has lectured extensively on the subject throughout the world.

Lawrence G. Roberts, Ph.D.'59, is president of GTE Telenet Communications Corp., where he has guided the organizational and technical development of the first packet-switching network in the U.S. to offer public service as an FCC-approved communications common carrier. . . . **Benjamin Leon**, Sc.D.'59, has been re-elected as vice president — educational activities of the Institute of Electrical and Electronics Engineers for the 1980 calendar year. . . . **Louis Weinberg**, Sc.D.'51, reports, "Spent three months in Japan on a research fellowship awarded by the Japan Society for the Promotion of Science. I was visiting professor at the University of Tokyo in the Mathematical Engineering Department and conducted research on matroids."

VI-A

Cooperative Program in Electrical Engineering and Computer Science

A record number of applicants is expected this year due to the large sophomore class in course VI. Some 250 students interested in learning about the program and how to apply came to an orientation session in February. The number of company openings should also equal or exceed last year's record high; 18 per cent of the total undergraduates and graduates in the department are currently enrolled in the VI-A program — 259 in all — the largest ever.

Indications are that a program of this size is severely taxing the commitment the department faculty can make in serving as VI-A faculty advisors and as graduate thesis supervisors at the various companies. Hence, only a slight expansion of the program is being allowed this year. One new company will join, the remaining expansion being within divisions or subsidiaries of companies already on the program.

Medtronic, Inc., Minneapolis, Mn., will join VI-A this spring. Medtronic manufactures 90 per cent of the cardiac pacemakers in use today. Both Pro-



From frying pan to fire, in the automobile business. As president of DeLorean Motor Co., Eugene A. Cafiero, S.M.'70, now has the job of moving the DeLorean DMC-12 off the magazine covers and into the hands of consumers before the end of 1980. It's a two-passenger sports car with gull-wing doors, the brainchild of John Z. DeLorean, former vice president of General Motors; a full-scale manufacturing plant with capacity for 30,000 cars a year nears completion near Belfast, Ireland.

Cafiero: Taking a New Hot Spot in the Automobile Business

Two months after Eugene A. Cafiero, S.M.'60, resigned as vice chairman of Chrysler Corp. late last winter, he was back in an automotive industry "hot seat" again. Now his problem, as president and chief executive officer of DeLorean Motor Co., is to bring to the market before the end of 1980 a radically new stainless-steel-and-plastic sports car to be built in Ireland principally for export to the U.S.

The DeLorean automobile was a gleam in the eye of John Z. DeLorean even before he left General Motors (he was vice president and group executive in charge of North American car and truck operations) in 1973; in earlier positions with the Pontiac and Chevrolet Divisions he had been involved with such famous designs as the Pontiac GTO and Chevrolet Monte Carlo.

But this time it's different — more ambitious by far. The DeLorean DMC-12 will be built with a stainless steel frame, plastic body structure, and stainless steel exterior panels. Power will come from a rear-mounted Renault V-6 aluminum engine with a Renault five-speed transmission.

And the cars will be built on a brand new assembly line in a brand new building on 70 acres in the outskirts of Belfast, Ireland, at the rate of around 15,000 a year, rising to perhaps 30,000 after two years. The total investment in plant, equipment, and tooling is nearly \$70 million, with another \$26 million of research and development costs.

fessor Roger C. Mark '60, and Professor Walter H. Olson of the M.I.T. Biomedical Center for Clinical Instrumentation have been involved in investigative projects with Medtronic. Adding Medtronic will broaden the opportunities for students interested in the bioelectrical engineering option to become affiliated with the VI-A program. Professor Olson, Helmholtz Associate Professor of Health Science and Technology at M.I.T., will serve as Medtronic's first VI-A faculty advisor.

The IBM Corp. plans to add assignments at its General Technology Division, Burlington, Vt., where solid-state and systems work is done. **Professor Richard B. Adler**, '43 will be the VI-A faculty advisor in addition to keeping his advisorship to RCA.

Motorola, Inc., which joined VI-A in the spring of '78, plans on placing several students at the Codex Corp., Mansfield, Mass. Codex became a Motorola subsidiary last year, and produces high speed microprocessor-based data communications system and equipment. **Professor Robert G. Gallager**, '57, will be Codex's first VI-A faculty advisor.

We were extremely pleased to read in *Tech Talk* of the generous support of M.I.T. of one of our very successful VI-A alumni. Mr. **Raymond S. Stata**, '57, president and board chairman of Analog Devices, Inc., has established on behalf of his company a \$125,000 fund to support a career development professorship in the Electrical Engineering and Computer Science Department. Ray stopped in to visit Director Tucker during a visit to M.I.T. last fall. He is currently serving on Massachusetts Governor King's High Technology Council.

Other VI-A news of interest: one of our current VI-A students, Charles Freeman '80, was awarded third prize in the IEEE Boston Science Paper Contest. His paper was entitled, "A System for Mechanical Inspection Using Acoustic Techniques." Chuck will be doing his VI-A graduate work at H-P Laboratories, Palo Alto, Calif., next summer. . . . **Oscar P. Manley**, '56, writes, "After four years of managing a part of the magnetic confinement fusion theory program (including a large portion at M.I.T.'s Plasma Fusion Center) at the Department of Energy, I am now in charge of a new program in the Office of Basic Energy Sciences at D.O.E. — namely, Basic Research Engineering."

It is great to see how many companies send VI-A graduates back to the campus for recruiting through our Career Planning and Placement Office. I had lunch with **David M. Bernstein**, '74, who was representing TRW, Inc., Torrance, Calif.; **Steven J. Frank**, '78, was here with a representative of the Rolm Corp., Santa Clara, Calif.; and **Mark S. Linsky**, '72, represented Hewlett-Packard's Computer Systems Division, Cupertino, Calif.

Also visiting the VI-A office was **Paul A. Lawson**, '70, who is development manager at Solar Power Corp., Woburn, Mass. . . . **Vincent J. Tobkin**, '73, called in to say 'hello' while passing through Boston on a business trip. Vince is with McKinney and Co. and has recently been transferred to their San Francisco office.

Another visitor was **James L. Fenton**, '78, presently with Walkins-Johnson Co., San Jose, Calif. . . . **Shahram Shirazi**, '75, stopped by to tell us that he is completing his studies in business administration at Stanford University. . . . And also stopping by with his wife Sally, a former secretary in the department, **Gary K. Montress**, '69, presently employed with the United Technologies Center, East Hartford, Conn. — **John A. Tucker**, Director, VI-A Program, M.I.T. Room 38-473, Cambridge, MA 02139

XIV Economics

George Galster, Ph.D. '74, reports that he has recently been promoted to associate professor of economics (with tenure) at the College of Wooster. He has directed the interdisciplinary urban studies program at Wooster; and received a grant

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from the United States Housing and Urban Development Program to study preferences for racial residential segregation. . . . **Vittoria Corbo**, Ph.D.'71, notes that he has been promoted to full professor of economics at Concordia University, Montreal, Canada.

Gordon Hern, Ph.D.'48, died on June 17, 1979.

. . . **Scott E. Pardee**, Ph.D.'62, has been appointed manager for foreign operations of the Federal Open Market Committee, the key policy-making body with the Federal Reserve System. . . . **Steven P. Zell**, Ph.D.'74, has taken a position as director of corporate planning with American Multi Cinema, Inc., Kansas City, Mo., after five years with the Federal Reserve Bank.

Norman R. Gibson, Ph.D.'74, moved from the Far East to London to establish, as managing director, a new merchant bank, Toronto Dominion International Bank Ltd. . . . **David L. Littmann**, S.M.'66, has been promoted to vice-president and senior economist at Manufacturers National Bank, Detroit, Mich. . . . **Ronald Zlatoper**, S.M.'75, is serving as commanding officer of Attack Squadron 85, on board U.S.S. *Forrestal* (CV-59) in the Mediterranean Sea during the Iranian crisis.

LeRoy E. Day, S.M.'60, was recently promoted to director, systems engineering and integration, Office of Space Transportation Systems, NASA Headquarters, Washington, D.C. . . . **Lietar Bernard**, S.M.'69, is presently heading the Organization Planning and EDP Departments of the Banque Nationale De Belgique (The Belgian Central Bank). . . . **Bradley E. Sparks**, S.M., moved from Miami, Fla., to Nashville, Tenn., and is vice-president for Truckstops Corp. of America. . . . **Dietrich Herrmann**, S.M.'73, is currently in his third year of German medical school (six-year program), supporting himself as a free-lance translator (German/English, English/German).

Richard C. Yonker, S.M.'74, is presently financial services controller for Inter Corp., a billion dollar semiconductor company, Santa Clara, Calif. . . . **Paul M. Golberg**, Ph.D.'71, is currently president of Sunrise Development Co., the land division of Forest City Enterprises, Inc. . . . **Albert Camp**, S.M.'56, reports, "Having discovered that goat milk solves the problem of cow's milk allergy and lactose intolerance for most affected people, I have been operating a goat farm and dairy since June, 1977."

XV

Management

Steven Mendelsohn, S.M.'71, is presently consultant manager, Aickling-Smith, Inc., Ottawa, Canada, developing training programs for Nigerian civil services. . . . **Larry P. Yermack**, S.M.'62, has recently been promoted to director, marketing and advanced planning for RCA's Astro-Electronics Division. . . . **Byron E. Miller**, S.M.'71, is presently assisting several Egyptian companies to modernize and expand their production and marketing capabilities. . . . **James Emery**, Ph.D.'65, is returning to the faculty at the Wharton School — after being away five years serving as president of EDUCOM, a membership organization of colleges and universities focusing on the use of computers in higher education.

Barbara R. Lewis, S.M.'71, is a lecturer in marketing at U.M.I.S.T., Manchester, England. . . . **Steve Shapiro**, S.M.'75, has been promoted to senior associate in the Washington, D.C. office of Management Analysis Center, a management consulting firm. . . . **Jeffrey C. Dyer**, S.M.'74, is presently practicing law in Morgantown, W.V., with the firm of Haden, Heiskell and Dyer. . . . **Richard N. Pigossi**, S.M.'65, recently joined the Private Investment Company for Asia (PICA) S.A., as senior representative, special projects.

XVI

Aeronautics and Astronautics

Robert A. Summers, Sc.D.'54, reports that since September, 1979, he has been director, Country

Energy Assessments, Office of International Affairs, United States Department of Energy, Washington, D.C. — responsible for conducting cooperative energy planning with developing countries. . . . **Jeffrey R. Kurland**, S.M.'70, is currently employed as manager of strategic planning for Digital Communication Corp., Gaithersburg, Md.

Viado Lenoch, S.M.'76, is senior engineer at Boeing Commercial Airplane Co. . . . **James W. Harrill**, S.M.'64, retired from the Air Force as lieutenant colonel, where his last assignment was in support of the airborne command post for the National Command Authority. He is beginning a new career with M.I.T. Lincoln Laboratory, supporting the residential application of photovoltaics. . . . **James S. Kennedy**, S.M.'64, is currently professor of aerospace studies (Air Force ROTC) at the University of Washington, Seattle, Wash. . . . **Michel Lermoyez**, '57, is director of business planning for IBM, Paris, France. . . . **Henry F. Lloyd**, S.M.'46, is on the administrative staff of Flagler College, St. Augustine, Fla.

XVIII

Mathematics

Joseph B. Muskat, Ph.D.'61, reports, "I cannot do much for the Alumni Fund, since I live on an Israeli salary. But I want to express, in a token fashion, my esteem for Dr. Jerome B. Wiesner in his final year. . . . **Mark J. Ablowitz**, Ph.D.'71, is chairman of the Department of Mathematics and Computer Science at Clarkson College of Technology. He was a delegate to an international conference in Kiev, Russia, sponsored by the National Academy of Sciences.

XIX

Meteorology

Richard Grant Ingram, Ph.D.'71, is chairman of the Marine Sciences Center at McGill University, Montreal, Canada. . . . **Elizabeth Daggit Haynes**, '53, is currently an oceanographer with the National Marine Fisheries Service, NOAA, relating climatic changes to the abundance of fishery resources. . . . **Stephen H. Scolnik**, S.M.'74, has left NOAA for a position on the technical staff of Comsat Laboratories. . . .

Technology and Policy Program

The TPP annual IAP trip to Washington, jointly sponsored with the Program in Science, Technology and Society and the Public Policy Program of the Department of Political Science, was a welcome opportunity to renew old acquaintances and catch up with news of far-flung alumni. *Marjorie Lyon of Technology Review* went with us, and her report appears on pages A4 to A8.

Andre Ghirardi, S.M.'78, recently passed his generals for a doctorate at the University of California (Energy Resources Group) at Berkeley. . . . **Adam Jaffe**, '76, formerly science associate with the Environmental Defense Fund in New York, and **James Tripp**, EDF attorney, recently published an article entitled, "Preventing Groundwater Pollution: Towards a Coordinated Strategy to Protect Critical Recharge Zones," which appeared in the *Harvard Environmental Law Review* (vol. 3, 1979, pp. 1-47). The authors discuss the nature of groundwater and the range of polluting activities; they propose a national groundwater management scheme within critical recharge zones.

Jon Weiss, '76, a presidential management intern with the National Highway Traffic Safety Administration, is on temporary assignment with the United States Regulatory Council and the Senate Anti-Trust and Monopoly Subcommittee. . . . **Dana Mukamel**, S.M.'77, is heading an effort to develop a comprehensive energy policy and plan for Israel's Ministry of Energy and Infrastructure. — **Professor Richard L. DeNueville**, Chairman, Technology and Policy Program, M.I.T. Room 1-138, Cambridge, MA 02139

How the Ancients
Moved Their Monoliths?



Allan Gottlieb is associate professor of mathematics at York College of the City University of New York; he studied mathematics at M.I.T. (S.B. 1967) and Brandeis (A.M. 1968, Ph.D. 1973). Send problems, solutions, and comments to him at the Department of Mathematics, York College, Jamaica, N.Y. 11451.

Several readers have asked about the deadlines for receiving solutions if they are to escape "Better Late Than Never" treatment. "Puzzle Corner" is written approximately two months prior to your receiving *Technology Review*. For example, today is January 20 (Superbowl Sunday), and I will be mailing my column in a week. This issue is due off the press during the last full week of March. Thus the deadline varies from three to six weeks after you receive *Technology Review*, depending on where the next issue falls in the *Review's* somewhat irregular publication schedule.

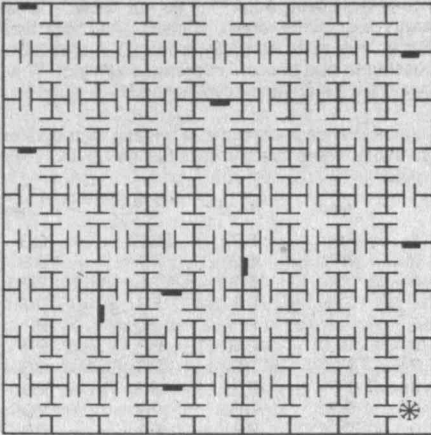
To reduce the number of citations under "Better Late Than Never," I now add names to the "also solved by" list when the galley proofs are reviewed. As a rule, however, the decision as to which solutions to publish cannot be changed at that time.

Jerome Taylor inquired as to the possibility of human computer chess collaborations. This is done occasionally during adjournments, and a "real-time" cooperative effort was tried by David Slate and his co-authored program CHESS 4.9. David Levy beat that team during the recent North American Computer Chess Championship.

Problems

M/A 1 We begin this issue with a bridge problem from Albert Fisher, who wants you to find a hand where declarer's trumps are only A,10 and dummy's only K,7 but in which declarer can make 12 tricks against any opening lead except trump. You are allowed to specify all four hands.

M/A 2 Moving from bridge to prison, we present a problem from Joan Baum, a York College colleague of mine:



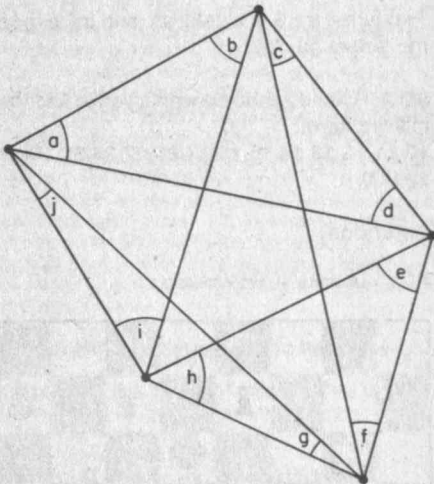
A prisoner was thrown into a medieval dungeon with 145 doors. Nine, shown by black bars, are locked, but each one will open if before you reach it you pass through exactly eight open doors. You don't have to go through every open door, but you do have to go through every cell and all nine locked doors. If you enter a cell or go through a door a second time, the doors clang shut, trapping you.

The prisoner (in the lower-right corner cell) had a drawing of the dungeon. He thought a long time before he set out. He went through all the locked doors and es-

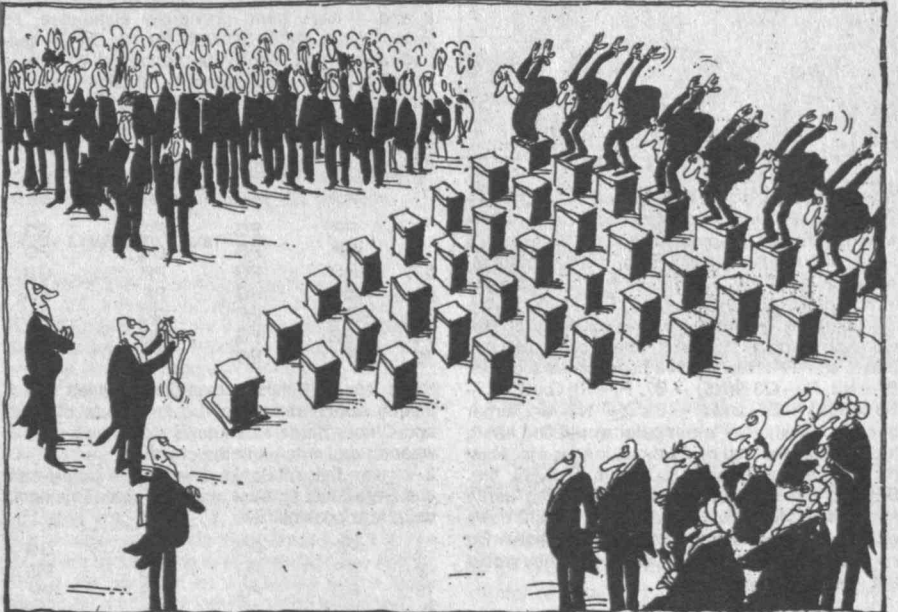
caped through the last, upper-left corner one. What was his route?

M/A 3 The Niculae Asciu cartoon (from the *New York Times*, October 9, 1977) on this page inspired Kenny Goldman to pose a probability problem (direct affirmative-action complaints to Asciu and the *Times*): What is each competitor's chance of reaching the winner's platform? Assume that each interior contestant may jump to one of the two nearest forward squares (50 per cent chance for each) and someone on the end must jump to the nearest forward square. When two contestants land on the same square they flip a fair coin and the loser is eliminated (in the real "Nobel race," the coins aren't always fair. — Ed). If this is too easy, try to find "optional strategies" for jumping right and left (instead of 50-50).

M/A 4 Now let's try a geometry problem from Gary Nelson:



Drawing the diagonals in a convex pentagon results in a five-pointed star. What is the sum of the measure of the angles exterior to



Selecting the Nobel winners (see M/A 3 above). (Niculae Asciu from the *New York Times*)

the star and bounded by the pentagon. Referring to the diagram, what is: a-b-c-d-e-f-g-h-i-j?

M/A 5 Problem 1977 O/N 2 asked for three perfect squares the sum of any pair of which is also a perfect square. Since then we have asked for four squares with the sum of any three a square, etc. Richard Hess noted that the original problem is equivalent to finding a rectangular (more precisely rectilinear) solid having integer-length sides and face diagonals. He wonders if one can find a rectilinear solid having integer-length sides, face diagonals, and space diagonal. That is, are there integers A, B, and C such that $A^2 + B^2$, $A^2 + C^2$, $B^2 + C^2$, and $A^2 + B^2 + C^2$ are all perfect squares?

Speed Department

SD 1 Edward Lynch has a secret message for us to decode:

ACBD α LMNO α OSABA R2 α GG
MNEOK ICD'P HOTI' R α URI
TU1D α .

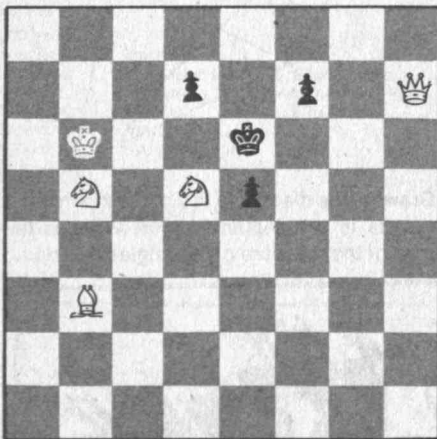
Two hints: the α is a goldfish, and try to read the letters quickly.

SD 2 Roland Janberbs wants you to find the missing term:

10 11 12 13 14 15 16 17 20 22 24 31 100 ?
10,000.

Solutions

NOV 1 A mate-in-two problem:



Some readers tried N(N5) — B7 ch, K — Q3, Q — R6. But P — B3 holds out one more move. If this were a solution, the problem would be a poor one since the solution begins with check. I also received K — B7, P — Q3, Q — R3; but again the bishop pawn moves, this time to B4. Smith Turner, G. Sharmon, Richard Hess, and the proposer were not fooled, however. They found the key move: B — R4. Now the five possibilities are: KxN B — N3, P — Q3 N(N5) — B7, P — K5 QxKP, P — B3 N (Q5) — B7, and P — B4 Q — N8. Mr. Turner questioned whether a computer would find short, tricky mates instead of a simple, longer win. Most of the best programs (such as CHESS 4.9, BELLE, and DUTCH) use increasing depth exhaustive searches. When they reach three plys (1.5 moves) they examine all variations. So no mate in two is "tricky" to them, and they would not even look at four plys.

NOV 2 The king wanted to find out who was the wisest among his three grand counselors. He

blindfolded the three and then announced that he had eight great seals, four purple and four gold. He would place two upon the forehead of each counselor, so that each counselor could see the four seals on his neighbors but not his own two seals. The last two seals he would place in a locked chest. The first counselor who determined the seals in the chest by correct reasoning would become supreme counselor; but if he guessed the answer, either rightly or wrongly, he would be beheaded. The king then put a purple seal and another on the head of Adak, a gold seal and another on the head of Baraz, and two more seals on the head of Cabul. After placing the last two seals in the chest, he removed the blindfolds and began questioning the three counselors. "What seals are in the chest, Adak?" "I do not know." "What seals are in the chest, Baraz?" "I do not know." "What seals are in the chest, Cabul?" "I do not know." Disappointed, the king tried again: "What seals are in the chest, Adak?" "I do not know." "What seals are in the chest, Baraz?" "I do not know." And this time Baraz answered correctly, changed his name to Kissinger, and became supreme counselor. What seals are on each man's forehead?

James Landau presents a clear, step-by-step solution. There are 19 possibilities for the eight seals:

	Adak	Baraz	Cabul	In Chest
1.	PP	PP	GG	GG
2.	PP	GG	PP	GG
3.	PP	GG	GG	PP
4.	GG	PP	PP	GG
5.	GG	PP	GG	PP
6.	GG	GG	PP	PP
7.	PP	PG	PG	GG
8.	PP	PG	GG	PG
9.	PP	GG	PG	PG
10.	PG	PP	PG	GG
11.	PG	PP	GG	PG
12.	GG	PP	PG	PG
13.	PG	PG	PP	GG
14.	PG	GG	PP	PG
15.	GG	PG	PP	PG
16.	PG	PG	GG	PP
17.	PG	GG	PG	PP
18.	GG	PG	PG	PP
19.	PG	PG	PG	PG

When Adak is asked the first time and he doesn't know, he eliminates 3 and 4, because each of these two possibilities has a unique configuration on the foreheads of Baraz and Cabul. Similarly, when Baraz doesn't know when asked the first time, we can eliminate 2 and 5. When Cabul says he doesn't know, we can eliminate 1 and 6. But we can also eliminate both 9 and 12. (There are three possibilities — 2, 3, and 9 — which would have Cabul see Adak wear PP and Baraz wear GG. But 2 and 3 have been previously eliminated, so Cabul eliminates 9. Similarly for 12. On the second run-through, since Adak cannot tell what he is wearing, we can now eliminate 10 (since the only other possibility with PP for Baraz and PG for Cabul is 12, just eliminated by Cabul). By similar reasoning, Adak eliminates 11, 14, and 17, Baraz now has the following possibilities:

	Adak	Baraz	Cabul	Chest
7.	PP	PG	PG	GG
8.	PP	PG	GG	PG
13.	PG	PG	PP	GG
15.	GG	PG	PP	PG
16.	PG	PG	GG	PP
18.	GG	PG	PG	PP
19.	PG	PG	PG	PG

Since each of these seven possibilities has a unique configuration on the foreheads of Adak and Cabul, Baraz now knows exactly what he is wearing and what is in the chest.

It is given that Adak has at least one purple seal and Baraz has at least one gold seal. This limits us to four possibilities:

	Adak	Baraz	Cabul	Chest
7.	PP	PG	PG	GG
8.	PP	PG	GG	PG
16.	PG	PG	GG	PP
19.	PG	PG	PG	PG

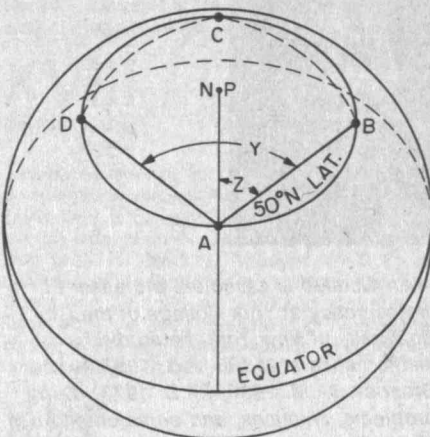
Therefore Baraz is wearing one seal of each color;

however, we do not have sufficient information to determine which seals are on Adak or on Cabul or in the chest. It should be mentioned that this problem does NOT determine which is the wisest of the three Counselors since 1) each Counselor has to assume the other two are equally good mathematicians 2) the choice of Supreme Counselor was forced by the King when he placed the seals.

Also solved by Matthew Fountain, Winslow Hartford, Richard Hess, Avi Ornstein, Howard Oster, and Ronnie Rybstein.

NOV 3 A spherical square ABCD is drawn on a sphere of radius R and center O, with each arc AB, BC, CD, and DA subtending an angle X at O and each vertex angle of size Y. Find Y as a function of X and the area of the square.

Irving Hopkins was able to navigate all the way through Roy Sinclair's problem. His solution:



Two formulas used in navigation, and one other, are necessary here. The first, (1), is used to calculate the great-circle distance between two points on the earth, corresponding to X in the current problem. The second, (2), finds the azimuth, Z, or the direction of the path at the take-off point, in terms of degrees clockwise from true north. The drawing shows that $Y = 2Z$. The third comes from the theorem stating that the area of a spherical triangle is equal to the square of the radius times the amount by which the sum of its angles, in radians, exceeds π . Given the latitudes of the points L_1 and L_2 and their longitude difference D,

$$X = \arccos(\cos L_1 \cdot \cos L_2 \cdot \cos D + \sin L_1 \cdot \sin L_2) \quad (1)$$

$$Z = \arccos\left(\frac{[\sin L_2 - \cos X \cdot \sin L_1] / \sin X \cdot \cos L_1}{\sin X \cdot \cos L_1}\right) \quad (2)$$

If the North Pole is at the center of the square — an excellent arrangement for our purposes — the corners of the square are all at latitude L and the longitudinal differences D are all 90° . The above equations then become:

$$X = \arccos(\sin^2 L) \quad (1)$$

$$Y = 2Z = 2 \arccos\left(\frac{[\sin L \cdot (1 - \cos X)] / \sin X \cdot \cos L}{\sin X \cdot \cos L}\right) \quad (2)$$

To find Y as a function of X, as requested,

$$\sin^2 L = \cos X \quad (from 1)$$

$$\sin L = \sqrt{\cos X}$$

$$\cos L = \sqrt{1 - \sin^2 L} = \sqrt{1 - \cos X}$$

Substituting these expressions in (2), we get

$$Y = 2 \arccos\left(\frac{[\sqrt{\cos X} \cdot (1 - \cos X)] / \sin X}{\sin X}\right) \quad (3)$$

To find the area, we divide the square by means of a diagonal into two equal triangles. The sum of the angles in each is $2Y$, to be expressed in radians. The area of each triangle is $R^2(2Y - \pi)$; the area of the square is twice this, or $A = R^2(4Y - 2\pi)$. Conversely, Y as a function of A is $Y = (A/R^2 - 2\pi)/4$ radians.

Also solved by Richard Hess, Edmond Nadler, Harry Zarembo, and the proposer.

NOV 4 The problem involves a swimmer, his sister, and his uncle. All swim at constant rates of two miles per hour relative to the water; and all want to cross a river one mile wide and flowing at one mile per hour from point A on one side to point C which is one mile downstream on the other side.

1. At what angle should the swimmer point himself, relative to the line AB which is perpendicular to the river? Find the time required and the distance swum.
2. The buoyant sister loves the water but hates exertion. What does she do?
3. The uncle, a self-made man, scorns the nephew's approach (too intellectual) and the niece's (too self-indulgent). He follows his life-long method of fixing his eye on the objective and steering straight for it. Find his path and how long he takes.
4. Let $V > 2$ be the speed of the river. At what angle θ should the nephew swim to cross the river and land as far as possible downstream from B? And how far downstream will he be?

Harry Zaremba swam and floated his way through this one:

1. Since the time required to traverse the distance AB will equal that required to cover distance BC, we have $t = 1/(2 \cos \theta) = 1/(2 \sin \theta + 1)$, or $2(\cos \theta - \sin \theta) = 1$. Squaring both sides and simplifying, $\sin 2\theta = 3/4$. Hence $\theta = \frac{1}{2} \arcsin 0.75 = 24^\circ 17' 42.68''$. The nephew's time to reach C will be $t = 1/(2 \cos \theta) = 0.54858$ hours, and the distance swum is $AC = \sqrt{2}$ miles.

2. To minimize exertion, it is presumed the nephew's sister would opt to cross the river in minimum time. If $t = 1/(2 \cos \theta)$ is differentiated with respect to θ and set equal to zero, we get $\sin \theta = 0$. Thus $\theta = 0^\circ$, which is to say that she should swim in a direction perpendicular to the river banks. Her time will be $t = 1/(2 \cos 0^\circ) = 0.5$ hours, and the distance traveled will be $d = (1^2 + 0.5^2)^{1/2} = 1.118$ miles. To reach point C, she can float downstream the remaining half mile.

3. At any instant of time, the uncle's swimming component will make an angle ϕ with respect to the river flow. His velocities perpendicular and parallel to the river will be, respectively,

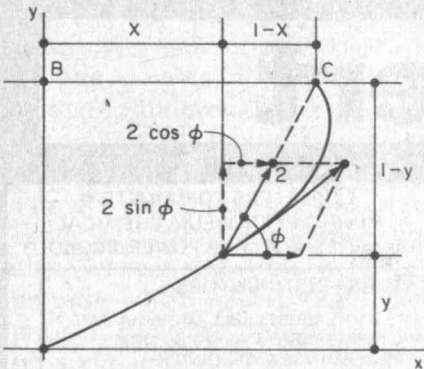
$$dy/dt = 2 \sin \phi \quad (1)$$

$$dx/dt = 2 \cos \phi + 1 \quad (2)$$

in which $\sin \phi = (1 - y)/D$ and $\cos \phi = (1 - x)/D$, with $D = [(1 - x)^2 + (1 - y)^2]^{1/2}$.

Dividing expression (1) by (2) and eliminating dt ,

$$dy/dx = (2 \sin \phi)/(2 \cos \phi + 1) = 2(1 - y)/[2(1 - x) + D]. \quad (3)$$



By assuming $w = (1 - x)$, $z = (1 - y)$, and $z = vw$, the variables can be separated in differential equation (3) to permit integration. The following solution of (3) is the uncle's swimming path:

$$(1 - x)^2 = (1 - y)(1 - y - k)^2/4k, \quad (4)$$

in which the constant of integration $k = 3 - 2\sqrt{2}$.

From equation (1), $dt = dy/(2 \sin \theta)$

$$= Ddy/2(1 - y). \quad (5)$$

Using a similar approach for integrating (5) as was used for (3), the expression for time at any instant is,

$$t = [(3k + 1) - (1 - y)^{3/2}] / -3k(1 - y)^{1/2} \quad (6)$$

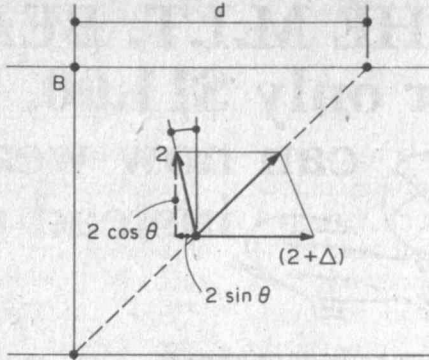
Since $y = 1$ when the uncle reaches point C, his total time to cross the river is derived from (6) to be

$$t = (3k + 1)/6\sqrt{k} = (5 - 3\sqrt{2})/3\sqrt{3} - 2\sqrt{2} = 0.609475 \text{ hours.}$$

4. Let the river velocity equal $(2 + \Delta)$ where Δ is any excess above 2 m.p.h., and let d equal the distance along the opposite bank downstream of

point B. The time elapsed to travel distance d will equal the time required to traverse the width of the river; thus

$$t = 1/(2 \cos \theta) = d/[(2 + \Delta) - 2 \sin \theta], \text{ or } d = [(2 + \Delta) - 2 \sin \theta]/2 \cos \theta.$$



For minimum distance, d is differentiated with respect to θ and set equal to zero. The result is $\sin \theta = 2/(2 + \Delta)$ or $\theta = \arcsin 2/(2 + \Delta)$. Substituting $\sin \theta$ and $\cos \theta = [\Delta(\Delta + 4)]^{1/2}/(2 + \Delta)$ into the expression for d yields the following minimum distance downstream of B:

$$d = [\Delta(\Delta + 4)]^{1/2}.$$

NOV 5 Mrs. Black and Mrs. Brown bought cloth, each paying as many cents per yard as she bought yards. Mrs. Green and Mrs. White bought groceries. Mrs. Green spent one cent more than the excess of twice Mrs. Black's payment over seven-ninths of Mrs. Brown's. Mrs. White spent as much as the sum of two-thirds of Mrs. Brown's payment and one-half of Mrs. Green's. Mrs. Black's expenditures was equal to five-sixths of Mrs. Green's payment, plus one-third of Mrs. White's. The total expenditure was more than \$1 and less than \$10,000. How much money, in dollars and cents, did each woman spend?

Winslow Hartford seems delighted ("A diaphantine equation — goody!" he writes) to solve this problem:

Mrs. Black buys x yards of cloth at x cents, spending x^2 . Mrs. Brown buys y yards of cloth at y cents, spending y^2 . Mrs. Green spends $1 + (2x^2 - 7y^2/9) = v$. Mrs. White spends $2y^2/3 + v/2 = w$. Further, $x^2 = 5v/6 + w/3$. Since v and w must be integers, $y = 3r$ and r must be an odd number. The above equations reduce to:

$$5r^2 + 2x^2 + 1 = 2w$$

$$-7r^2 + 2x^2 + 1 = v$$

$$6x^2 = 5v + 2w.$$

These in turn reduce to $5r^2 - x^2 = 1$. The trivial solution is eliminated because the total amount spent is $> \$1$. The next solution is $r = 17$, $x = 36$, whence $y = 51$. Mrs. Black spent $x^2 = \$14.44$; Mrs. Brown spent $y^2 = \$26.01$; Mrs. Green spent $.01 + 28.88 - 20.23 = \$8.66$; and Mrs. White spent $17.34 + 4.33 = \$21.67$.

Also solved by Ari Ornstein, Frank Carbin, P. Jung, Richard Hess, Harry Zaremba, Naomi Markovitz, Arthur Haines, James Landau, and Steve Feldman. John Rule, the alleged proposer, does not remember submitting this problem.

Better Late Than Never

1978 NOV 2 B. Laporte has responded.

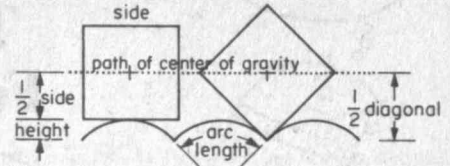
1979 A/S 1 Raymond and Edward Gaillard and Robert Enders note that if White plays P—B8(Q), Black draws with R—B5 ch, QxR stalemate. Thus only the P—B8(R) line can be used.

A/S 2 Raymond Gaillard has responded.

OCT 2 James Landau has responded and John Bush, who is this column's proofreader at *Technology Review*, constructed a model (see photo) and has submitted the following:

The expression $y = \log_e(x + \sqrt{x^2 - 1})$ is equivalent to $e^y = x + \sqrt{x^2 - 1}$, and its reciprocal is $e^{-y} = x - \sqrt{x^2 - 1}$. Adding them; we get $e^y + e^{-y} = 2x$, which by definition is equivalent to $x = \cosh y$. This is the equation for a catenary — the curve formed by a chain or flexible string when held up by its ends. In order for the corners of the square to mesh with the cusps in the track, the length of

the string, the side of the square, and the arc length of the humps must all be equal. Comparing the square in the two positions, we can see that the height of the hump equals half the diagonal minus half the side of the square:



Therefore, to obtain the correct shape for the hump, take a string as long as the side and hold it up so that its depth equals this height. This technique also works for rectangles and regular polygons; with a little modification it probably works for any polygon. There exist dozens of blocks of stone, weighing hundreds of tons each, at building sites scattered all over the ancient world. Little if anything is known about how the ancient builders moved these blocks. The intriguing possibility is that they discovered this trick with a string without any knowledge of modern mathematics.

OCT 3 The proposer, Emmett Duffy, submitted a solution with this problem.

OCT 4 The proposer, John Rule, submitted a solution with this problem; and James Landau has responded.

A/S SD 1 R. Boas, editor of the *American Mathematical Monthly*, writes the following proof for the theorem that there is a correct English sentence containing an arbitrarily large number of consecutive "had"s: Suppose that you already have a correct sentence containing a string of n "had"s. Let us use x to stand for this string, purely as an abbreviation which can be expanded when desired. Now consider the sentence, "My composition would not have contained x had x not been a correct English phrase." This, when expanded, is a correct English sentence containing $(2n + 1)$ consecutive "had"s. (If you replace "contained" by "had," you have $(2n + 2)$, but it's hardly worth the loss in clarity.)

Proposers' Solutions to Speed Problems

SD 1 PH is like Ph in Philadelphia, O is like O in women, and TI is like ti in nation. Hence:

Abie, see the goldfish!

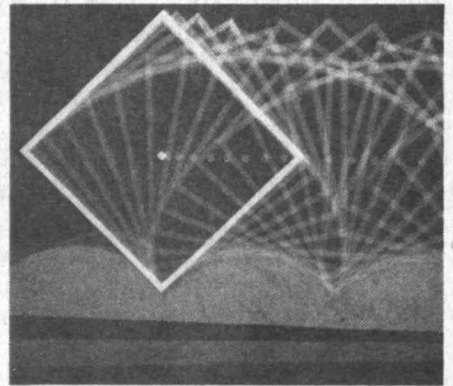
Hell, them ain't no goldfish!

Oh yes, Abie, they are, too, goldfish.

Gee, giminy. Okay, I see the fish are goldfish.

You are right. You won the goldfish.

SD 2 121. The numbers represent 16 written in base 16, base 15, ..., base 2.



A multiflash photograph of a block of stone rolling down a "scalloped" roadway, a demonstration of John Bush's three-dimensional solution to **OCT 2**. The road is tipped up a few degrees, and the block moves down it powered only by gravity. The small spot in the middle of the block marks its center of gravity; note that it traces a straight line. (Photo: © 1979 John D. Bush and Glenn Howlett)

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... otherwise the noxious and deadly vapors of the lead furnace are inhaled." However, Pliny also advised that wine be kept in leaden vessels to avoid the toxic and bitter taste of copper. This use of lead and its widespread employment in plumbing (the Latin root of the word "plumber" is *plumbum*: "lead") have been suggested as contributing to the lower birth rate and increased prevalence of mental disturbance in the Roman ruling class, and hence to the decline of Rome (see "*Lead Poisoning: Is History Repeating Itself?*" June/July 1979, p. 77).

Sir George Baker drew the attention of eighteenth-century Europe to lead's dangers when he traced the cause of the Devonshire colic epidemic to cider produced in lead vats. Baker, a resident of Devonshire, was initially reviled by local industrialists, the medical profession, and the clergy, but later was knighted and became a royal physician.

At about the same time, the Massachusetts Bay Colony was engaged in the profitable commerce of distilling rum and shipping it to North Carolina for consumption. When North Carolinian drinkers developed "the dry gripes," diagnosed as lead colic caused by rum stored in lead containers, the Massachusetts authorities responded by passing in 1723 one of the earliest public health measures in America: a state ordinance entitled "An Act for Preventing Abuses in Distilling of Rum and Other Strong Liquors with Leaden Heads or Pipes." This action was taken more to protect the Massachusetts rum industry than the North Carolinian consumers. The act prohibited the use of lead worms or still-heads and called for licensed factory inspectors. It also set penalties for violators as high as 100 pounds, which were to be divided equally among the poor of the town and the individual who informed on a violating distiller.

Benjamin Franklin left Boston for Philadelphia the year this act was promulgated, and 65 years later in a letter to Benjamin Vaughn, wrote "... I remember ... a general discourse in Boston when I was a boy of a complaint from North Carolina against New England rum, that it poisoned their people giving them the dry bellyache, with loss of the use of their limbs." Later in this letter Franklin commented on the association of colic with the drying of lead printer's type in fire and other lead-associated activities, such as painting.

Probably the first observation that children suffer from lead poisoning was made in 1891 by J.L. Gibson, an Australian ophthalmologist. He established lead as the cause of ocular palsies and neuritis in a

number of children. A.J. Turner, a colleague, noted that many of these children became ill after changing residence, but he was unable to specify the source and characterized the lead poisoning as a "toxicity of habitation." Gibson determined in 1904 that many of his patients were nail-biters or thumb-suckers, and suggested the origin of the lead to be the paint in the children's homes. While all children tend to mouth foreign substances, it was recognized that some persist in the habit and can take in huge doses of lead in this fashion. At this time childhood lead poisoning was considered primarily a disease of urban children with paint as its major, if not only, source.

But this conclusion ignored other important observations. At the turn of the century, British factory inspectors reported startlingly high levels of barrenness, stillbirths, and first-year infant death among women exposed to lead through the manufacture of pottery.

It was not yet known that lead in pregnant mothers could affect the development of their infants' brains, but data pointing in this direction did exist. In Glasgow, where the water is soft and often stored in lead-lined tanks, Professor Abraham Goldberg of the University of Glasgow showed an increased incidence of mental retardation in children born in homes where the water supply contained excessive lead. Some blood samples from retarded children drawn at one week of life had significantly higher lead levels than did the blood of control subjects.

Modern Sources of Environmental Lead

A considerable portion of dietary lead originates in pesticide sprays, cooking utensils, and solder in cans. Lead in water may be a source for individual households if the water is soft (of low mineral content) and acidic, and the pipes are made of lead (conditions found in some homes in older Eastern cities such as Cambridge and Boston).

Lead put into the air by obvious stationary sources such as smelters is a major problem for nearby communities, but automobile emissions are a much greater contributor. In 1975, based on the use of lead-based gasoline additives, approximately 150,000 metric tons of lead were emitted into the atmosphere over the continental U.S. After combustion, most of the lead leaves the tailpipe as lead bromide. Larger particles fall out rather promptly into the dirt and soil by the roadside. Smaller particles tend to stay airborne and travel farther.

Lead exposure has long been recognized as a threat to smelter workers, battery plant operators, painters, and ship breakers. In such workplaces lead dust permeates the air and blankets the ground. A substantial part of that lead is inspired and absorbed.

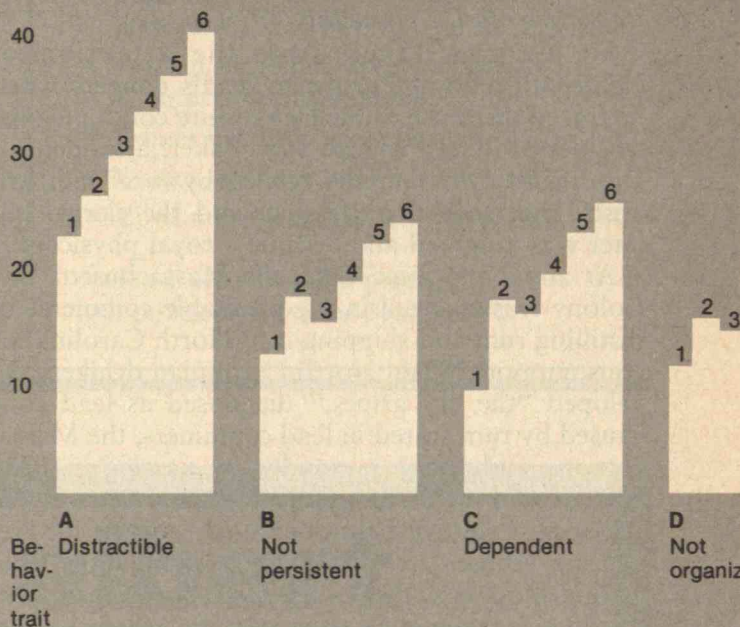
Pathways into the Body

Lead enters the human body through two major routes: the gastrointestinal (GI) tract and the lungs. The contribution of each source to a person's lead burden and physiological impact varies especially with age and environment. Obviously, a toll collector at the Lincoln Tunnel will have a different partition of sources than either a battery worker or an inner-city child. Of the portion of lead introduced into the GI tract of an adult, about 10 per cent is absorbed; however, a child's gut is much more permeable and may absorb as much as 50 per cent. About 40 per cent of small particles of inspired lead (less than 1 micrometer in diameter) is retained and absorbed in the lungs. Some evidence exists that suggests a higher proportion of inspired lead is absorbed into children's lungs.

Lead paint poisoning continues to be a serious problem for children, despite the fact that lead was phased out in pigment in the 1940s and then banned as a drying agent in the 1970s. Many houses have paint over 40 years old, much of which is flaking and peeling. Some children, for not well understood reasons, persist in the habit of eating foreign substances, and some develop a specific taste for lead. Enormous quantities can be ingested in this manner. Even if the paint does not peel, it slowly weathers and chinks, and thus contributes to lead in dust. Ordinary urban dust contains surprisingly high amounts of lead (up to 1 per cent), and the typical hand-to-mouth behavior of children can result in significant absorption.

It was once assumed that when a child recovered from lead poisoning and the symptoms subsided, brain function returned to normal. But this belief was refuted in 1943 by Drs. Randolph Byers and Elizabeth Lord at the Boston Children's Hospital. They studied 20 children thought to have recovered from acute lead intoxication and found that 19 were behavior-disordered or failing in school and that most had sensory-motor defects. They raised, perhaps for the first time, the troubling question of whether undiagnosed lead poisoning was a source of some school and behavior problems.

Per cent of students to exhibit behavior trait noted, as reported by teachers	Class	Average amount of dentine lead (ppm)
	1	<5.1
	2	5.1 — 8.1
	3	8.2 — 11.8
	4	11.9 — 17.1
	5	17.2 — 27.0
	6	>27.0



In Pursuit of Epidemiologic Data

The growing realization over the past ten years that many thousands of children have elevated blood lead levels has directed considerable attention to two questions:

- ☐ Does lead, at doses below those that produce symptoms dramatic enough to put children in the hospital, cause impairment in neuropsychologic function?
- ☐ Can low levels of lead in the body cause slight impairment of brain function that could be manifested as learning disabilities, detectable brain disorders, or school failure?

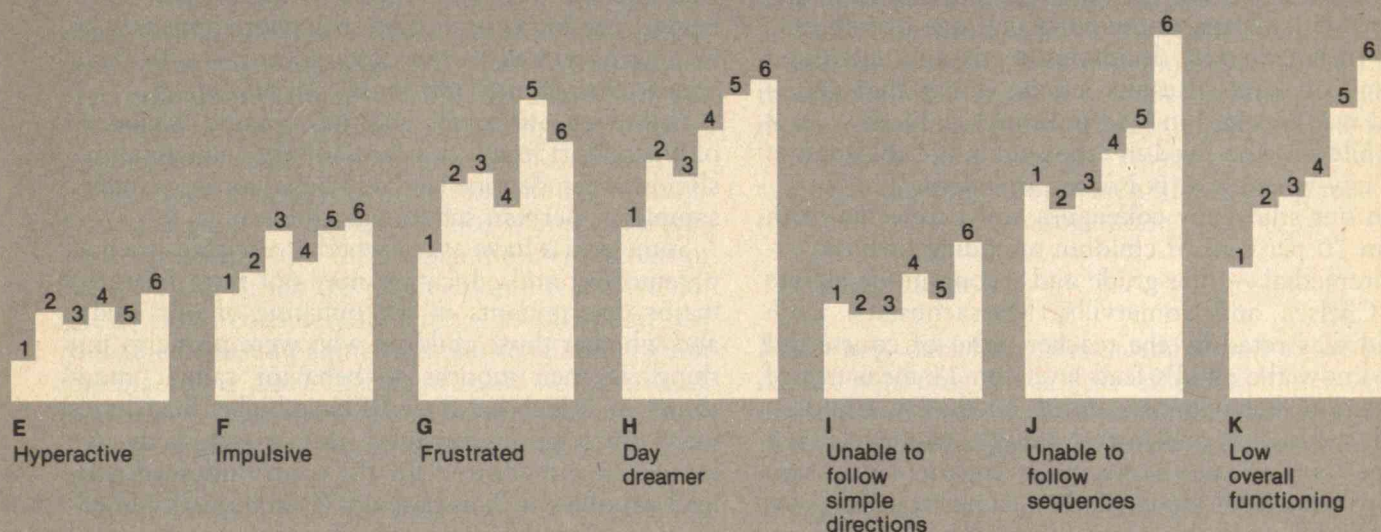
Since 1972 physicians have conducted a large number of epidemiologic studies of lead-exposed children. The authors of most studies classify children into "exposed" or "nonexposed" groups by measuring the amount of lead in their bloodstream. The children are then evaluated on a number of psy-

The distribution of eleven measures of negative behavior, as rated by teachers for 2,146 first- and second-grade children in Chelsea and Somerville, Mass., in relation to the concentration of lead in the students' deciduous ("baby")

teeth. Note the striking positive correlation between increasing amounts of dentine lead and the prevalence of negative behavior. (Data: H. L. Needleman et al. in the New England Journal of Medicine)

- A Is this child easily distracted during his/her work?
- B Can he/she persist with a task for a reasonable amount of time?
- C Can this child work independently and complete assigned tasks with minimal assistance?
- D Is his/her approach to tasks disorganized (constantly misplacing pencils, books, etc.)?
- E Do you consider this child hyperactive?

- F Is he/she over-excitable and impulsive?
- G Is he/she easily frustrated by difficulties?
- H Is he/she a daydreamer?
- I Can he/she follow simple directions?
- J Can he/she follow a sequence of directions?
- K In general, is this child functioning as well in the classroom as other children his/her own age?



chological performance or competence tasks, and "high-lead" and "low-lead" subjects are then compared. Dr. Bridgette de la Burde and M. S. Choate in Virginia, Dr. Philip Landrigan and coworkers at the Center for Disease Control, and Joseph Perino and Claire Ernhart at Hofstra University found that children with increased lead exposure clearly performed less ably than nonexposed children. But others — including Richard Lansown and coworkers at the Great Ormond Street Hospital (formally the Hospital for Sick Children) in London, Dr. David Kotok and coworkers at Yale-New Haven Hospital, and Dr. Robert W. Baloh and coworkers at UCLA — were unable to detect a difference.

Among the reasons for discrepancies in the conclusions of these studies are certain methodological flaws that are common to many epidemiologic investigations. The four most common are these:

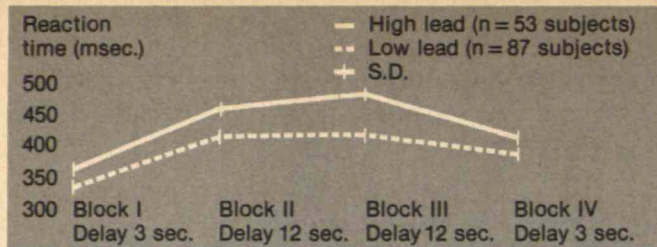
□ *Inadequate classification.* The presence of lead in the blood is only a short-term measure of exposure.

Lead in the blood of a child may drop to normal levels after the child suffers a severe dose.

□ *Selection bias.* In a free society, parents and children may decline to participate in an epidemiologic study. Their choice may be related to the outcome of interest. For example, the parents of children suspected of being handicapped might not wish to have the children examined. Such a survey would then miss the children with the greatest deficit.

□ *Insensitive measures of outcome.* The detection of subtle impairment requires sensitive tools. Some studies that employed rather coarse screening measures have not discovered differences.

□ *Lack of attention to other variables that affect outcome.* Many other factors can influence the development of children, and some of these can segregate with lead. While lead is not exclusively a problem for children of poor families, it is true that such children generally experience more lead exposure. Factors other than lead poisoning assault the de-



The time in milliseconds needed for 140 first- and second-grade children to react to a command stimulus (a buzzer), with varying delays between a warning signal (the word "ready") and the stimulus. Each child had six

trials in each block of testing. Note that the 53 high-lead children were consistently slower to react than were the 87 low-lead children. (Data: H.L. Needleman et al. in the New England Journal of Medicine)

velopment of the poor: inferior nutrition, increased infections, and less-than-adequate schools.

My group at the Children's Hospital Medical Center in Boston set out specifically to address these four methodological issues in a large study of children considered asymptomatic for lead. To avoid the shortcoming of using blood lead levels as an indicator of plumbism, I needed a tissue that accurately traced the past history of exposure to lead in older children. Lead is deposited in bone, but bone biopsies involve risk and discomfort. It occurred to me, as it had to others, that deciduous teeth would provide a universal, spontaneous, and painless bone biopsy of children at the particular age of interest.

I then collected deciduous teeth and measured their lead levels. Results left no doubt that dental lead was elevated in lead-poisoned children — and in children who lived in "the lead belt," the zone of the city where lead poisoning is endemic.

In our study, my colleagues and I collected teeth from 70 per cent of children attending ordinary — nonremedial — first-grade and second-grade classes in Chelsea and Somerville, Massachusetts. Each child was rated by the teacher (who of course did not know the child's lead level) on 11 measures of classroom behavior (see graph on p. 43). Children with the highest and lowest dentine lead levels then were invited to participate in our intensive neurobehavioral study. If they came from English-speaking households, were full-term babies, had experienced no serious head injuries, and were never previously diagnosed as having excessive lead exposure, they were admitted, with parental approval, to the study. (We later compared dentine lead and the 11 measures of classroom behavior of children included and excluded from the neuropsychologic study. We found the children included in the study did not differ in these respects from those who did not participate.)

Each child was individually tested by examiners who were unaware of the child's lead status. Part of the three-hour neuropsychologic examination included having mothers complete a comprehensive questionnaire and take an IQ test. We then compared "high-lead" and "low-lead" children on a large number of variables. We identified numerous nonlead variables that did not correlate with dentine lead level, such as height, weight, head circumference, gender, and race. Other nonlead variables such as size of family, age, education, and IQ of mothers and socioeconomic status of fathers that did correlate with dentine lead levels were controlled

in the final biostatistical evaluation by a procedure known as the analysis of covariance.

Our overall findings clearly linked lead and behavioral problems. High-lead children were found to perform significantly less well on the Wechsler Intelligence Scale (especially on the verbal tests), on a number of tests of auditory and language skills, on the ability to maintain attention, and on classroom behavior as previously measured by teachers' ratings. Indeed, when the entire sample of 2,146 students (92 per cent of the 2,335 children who submitted teeth) were classified according to dental lead and the teachers' reports of each negative behavior, the increase in these behaviors appeared to be clearly related to the dose of lead — *and there appeared to be no "threshold" for this effect.*

Following our study, Drs. Hrdina and Winnecke of Dusseldorf found substantially the same relationship between dentine lead and behavior in a smaller sample of German school-age children.

Some critics have asked whether variables such as parental IQ and education may not have been the major determinants in the outcome of our study, and whether those children who were prone to put things in their mouths — behavior called "mouthing" — which led them to have higher lead levels were not a priori impaired. But in our study, we measured and allowed for the contribution of nonlead variables such as parental IQ and quality of education. And the effect of lead on neurobehavioral function clearly persisted after controlling for those nonlead variables. We compared the intelligence and language performance of children with reported excessive mouthing behavior and found no significant differences from nonmouthing children who had similar levels of lead in their teeth.

Other compelling responses to the critics come from laboratory studies conducted with animals, where such rearing variables as maternal IQ and mouthing behavior can be completely and systematically controlled:

□ Philip Bushnell and Robert Bowman at the Wisconsin Primate Laboratory recently demonstrated slowed visual learning in young rhesus monkeys whose blood levels did not exceed 40 to 60 micrograms of lead per deciliter of blood.

□ Ellen Silbergeld and coworkers at the National Institutes of Health have shown that lead interferes with neurochemical function at the subcellular level by altering the concentration and flow of sodium and calcium ions. These changes may then affect the activity of cholinergic and dopaminergic neurons,

Souvenir of the epidemiological study in which lead levels in deciduous teeth were found to correlate positively with negative behavior in the

classroom. A button was given to each of the participating first- and second-graders. (Photo: Leonard A. Phillips)



which can retard brain function.

□ David Taylor and coworkers at the University of Colorado Medical Center in Denver have shown that lead micropipetted in minute quantities into rat brains decreases norepinephrine-mediated inhibition, and thus affects central neurotransmission.

□ A number of other workers have demonstrated teratogenic properties (factors that produce birth defects) of lead given during pregnancy to experimental animals.

Recent Attempts at Controls

One of the stagnating — if not paralyzing — activities of regulatory agencies and some industries has been repeated attempts to shift the blame for environmental lead to a source outside their individual responsibility. Such actions have led to an interesting phenomenon in which the lead industry indicts paint and paint eating as the major source of serious lead exposure in the U.S., while the Department of Housing and Urban Development and real estate interests go to considerable lengths to downplay the role of lead-based paint as a threat to children. Paint manufacturers agree that paint could be hazardous, but extend their immediate concern only to paint already applied and not to unsold paint in cans on store shelves.

In the 1960s, U.S. cities and poor people reentered the zeitgeist. Epidemiologic data collected during that period indicated that as many as 10 per cent of our children had blood lead levels close to the range defined as toxic (above 60 micrograms of lead per deciliter of blood). A coalition of inner-city mothers (some of whose children had been lead-poisoned), public interest lawyers, and a few physicians brought these data into public scrutiny, and two major legislative thrusts resulted:

□ In 1971 Congress passed the Lead Paint Poisoning Prevention Act, which established early detection as a strategy, provided for limited environmental control, called for further research, and defined the toxic level of lead in paint to be 0.5 per cent by weight. In 1973 the act was amended, lowering the permissible level in paint to 0.06 per cent. In 1975 the Consumer Product Safety Commission ruled that any paint with lead concentrations greater than 0.06 per cent by weight was unsuitable for household use.

□ In 1970 the Environmental Protection Agency was mandated by Congress under the Clean Air Act to prepare air standards on certain hazardous sub-

stances, including lead. But by 1975 the EPA had not acted. A suit brought by the Natural Resources Defense Council against the EPA was upheld by the courts, which ordered the EPA to prepare the standards. The first draft of the scientific document issued by the EPA asserted that a national airborne lead standard of 5 micrograms of lead per cubic meter of air was adequate to protect public health. But this concentration was two and a half times greater than previous EPA estimates and was at considerable variance with the opinion of many non-EPA scientists. After a stormy series of public hearings, the EPA staff was advised by its scientific advisory board not to revise the draft, but to destroy it and begin anew. After two more drafts, the EPA recommended a level of 1.5 micrograms per cubic meter, which was the standard later promulgated by EPA administrator Douglas Costle — and which is currently the issue upon which EPA is being sued by the Lead Industries Association.

The Lead Outlook

Many new data have been accumulated in the past decade regarding the dangers of lead to humans and especially to children. Analysis of these data indicate that the effects of lead are found at lower levels of exposure than were previously recognized, and that any apparent threshold of adverse biologic effects varies with the sensitivity and rigor of the investigative method. It seems likely that the standard for acceptable exposure to lead, given the history of scientific progress, will require further downward revision as new information is gathered and evaluated.

Further Reading

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Needleman, H. L., ed., *Low-Level Lead Exposure: The Clinical Implications of Current Research*. New York: Raven Press, in press.

Needleman, H. L., C. Gunnoe, A. Leviton, et al. "Deficits in Psychologic and Classroom Performance of Children with Elevated Dentine Lead Levels." *New England Journal of Medicine* 300 (1979): 689-695.

Singhal, Radhey, L., and John A. Thomas, eds., *Lead Toxicity*. Baltimore: Urban and Schwarzenberg Medical Publishers, 1980.

Herbert L. Needleman, a pediatrician and psychiatrist, is director of the Lead Exposure Studies Program at the Children's Hospital Medical Center of Boston and Harvard Medical School. His attention was drawn to the role of hidden lead poisoning in brain dysfunction while he was director of consultation and education at the Temple University Community Mental Health Center in Philadelphia, where he set up programs for retarded and behavior-disordered children.

Science, Technology, and the Press: Must the “Age of Innocence” End?

A group of distinguished science journalists discuss communication — of facts, ideas, and opinions — and the public’s need to know.



Walter Sullivan
New York Times



Edward Edelson
New York Daily News



Mark Dowie
Mother Jones

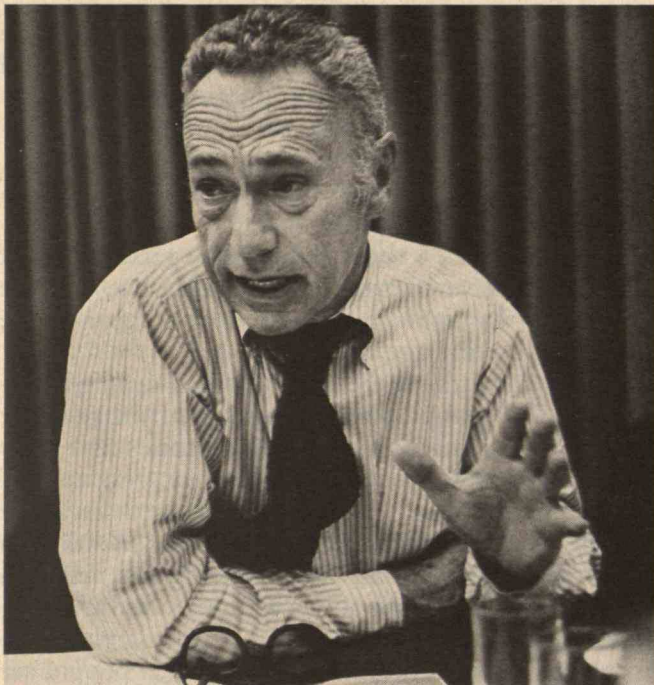
We live in a time of intersecting and apparently conflicting attitudes toward issues in science and technology: the energy “crisis” . . . the question of public confidence following such events as the Three Mile Island accident and the DC-10 crash in Chicago . . . the national debates on technology for defense . . . growing concern over technological innovation and productivity . . . the implications of “soft” energy and “natural” lifestyles . . .

These many discordant attitudes are the responses, at least in part, to perceptions of science and technology that Americans gain from newspapers, magazines, television, and radio. And these media, in turn, depend heavily for their reports on a small corps of writers and broadcasters who over the years have learned so much about science that they have become its principal communicators.

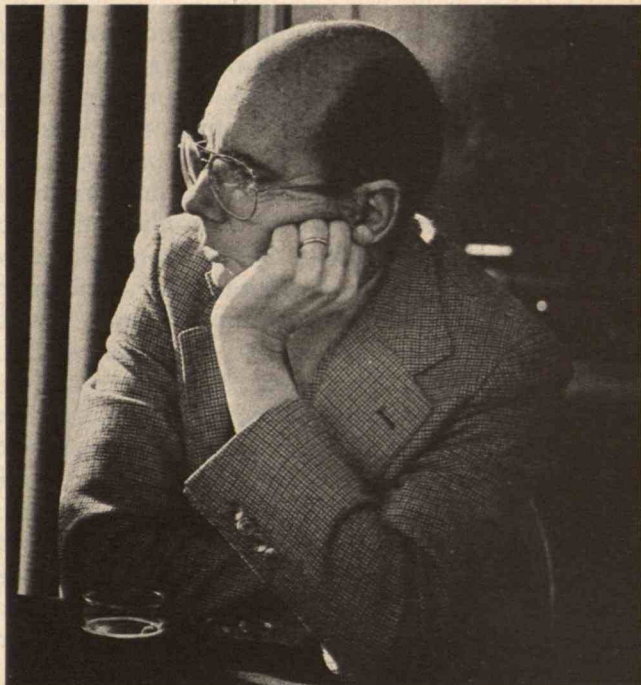
What can these communicators tell us about what Americans really think of science and technology and — especially — about the processes by which such attitudes are formed?



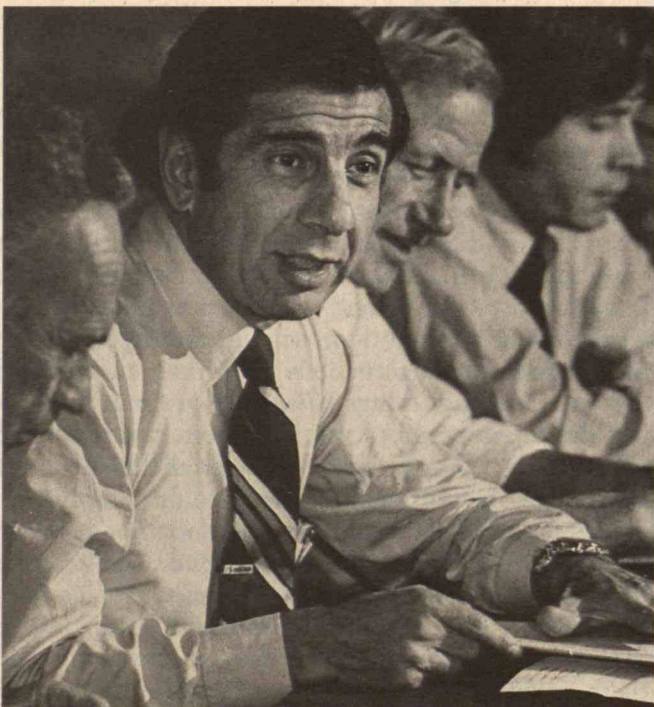
Thomas O'Toole
Washington Star



David Perlman
San Francisco Chronicle



Robert Cooke
Boston Globe



Jules Bergman
ABC News



Cristine Russell
Washington Star



Intrigued by these questions, *Technology Review* asked eight prominent science journalists to explore with us some of the issues — of perception, involvement, responsibility, and impact — at the “interface” of science and public affairs.

Our discussion took place early in January in San Francisco, where many of the nation’s leading science writers had come to cover the annual meeting of the American Association for the Advancement of Science. Participating were Jules Bergman, science editor of ABC News; Robert Cooke, science editor of the *Boston Globe*; Mark Dowie, publisher of *Mother Jones*; Edward Edelson, science editor of the *New York Daily News*; Thomas O’Toole, science editor of the *Washington Post*; David Perlman, associate editor and science editor of the *San Francisco Chronicle*; Cristine Russell, science reporter for the *Washington Star*; and Walter Sullivan, science editor of the *New York Times*. The discussion was moderated by Steven Marcus, managing editor of *Technology Review*.

As you’ll see from what follows, science writers are as eloquent behind microphones as in front of typewriters. They are at once good reporters and thoughtful philosophers of science and of their role as communicators; and their opinions are by no means unanimous. Here’s a (slightly edited) transcript of our conversation.

A New Interest in Science

TECHNOLOGY REVIEW: There is a noticeable increase, these days, in the amount of reporting on science and technology — new magazines, expanded sections of newspapers, and so forth — mostly for a general readership. What are your thoughts about your expanding audience and its needs?

COOKE: I’m not so sure it’s an expanding audience. I think there’s a *perception* of an expanding audience, but I don’t know if it’s large enough to respond to all the new magazines and sections.

EDELSON: I think this is analogous to other areas in journalism — reports on the new impotence or the epidemic of teenage pregnancies, for example — where the written account, and the problem it pur-

ports to describe, are accepted at face value. People have been writing about the new antiscientific mood that’s sweeping the American public, and now publishers are rushing to put out new, popularized magazines to fill the “void.”

TECHNOLOGY REVIEW: So you don’t think anything has really changed?

EDELSON: No, I think publishers’ perceptions of the market have changed. But it’s also true that the generation brought up with *Sputnik* is now at the magazine-buying age.

SULLIVAN: I think the audience has definitely expanded. The baby-boom generation of the postwar period is now mature — in their twenties and early thirties — and as Ed Edelson said, they grew up during the *Sputnik* era, a period of enormous discovery and excitement in the scientific field. In addition to Project Apollo and all the observations made in space, there have been such things as test-tube babies and recombinant DNA — really great landmarks in science — and I think a lot of people are hooked on that. For the first time in human history, it looks as though people believe the only way out of our present dilemmas is through wise use of science and technology.

COOKE: Yes, with more rather than less.

PERLMAN: Certainly, people have begun to see science as something that’s interesting and fun; and even the so-called antiscience wave that Ed was talking about is a wave of puzzlement about what to do — as human beings, as voters, as political decision makers. People worry about the recombinant DNA issue, they worry about nuclear power, and they worry about all the other social questions that have to be addressed, ultimately, by politicians. And they’re not going to buy *Science* 80 or *Omni* or *Geo* for the answers. But certainly their curiosity and concern must be piqued by some of the events, and those who are conscientious want to find out more.

RUSSELL: People read about science not because they are either proscience or antiscience, but because they’re just generally interested in science. The market has been there, although mostly dormant, since the early ’70s. I worked for one of the earliest of these publications — the special science issue of



Saturday Review — and everyone there was quite aware of a large potential audience. The magazine folded, unfortunately, not because of market problems but because of the way it had been set up, and for five years thereafter the market remained untapped. Now, almost all the people who worked on that publication are working for these new magazines.

O'TOOLE: I think that's right. I'm surprised publishers took so long to recognize that science was an interesting subject and that most people wanted to read about it. Besides, people are becoming fed up with politics — with things like Watergate — and they want to read about something else.

COOKE: They're getting tired of *Us* and *People* magazine, too, and they want something a little more substantial.

O'TOOLE: So now there's going to be a stampede — even though people have been interested in science, I think, since the '60s and '70s — and we'll probably see a lot of bad magazines. But there will be a shake-up, and a fallout, and the good ones will survive.

EDELSON: I think what we're really discussing is a dual phenomenon: an increased interest in science and a simultaneous increase in the antiscience mood. And the new activities in journalism will travel both routes.

No More Happy Talk

TECHNOLOGY REVIEW: A fair number of people, having studied the so-called antiscience, antitechnology movements, conclude they're not antitechnology at all but are opposed to certain *kinds* of technology and to the values they represent.

COOKE: Even if people want to go all the way back to the woods, they take a chain saw with them.

O'TOOLE: And a freezer.

SULLIVAN: The Vietnam War, it seems to me, provoked a very definite antiscience feeling. Science and technology were used (or misused) to produce napalm, the "Agent Orange" herbicide, and so on — applications of which a large part of the population disapproved. But it also seems to me that this feeling has been mitigated since the end of the war.

BERGMAN: What distresses me is that I find the stakes get higher and higher all the time. I see this myself, I hear it from my producers, and I read it in the mail I get: people blame scientists and engineers, as well as leaders, for Three Mile Island, for DC-10s, for all our failures. And I find — maybe I'm a moralist on this score — that too many engineers, to protect their jobs, remain quiet when they see something defective going by. At the FAA, they call this the CYA (cover your ass) phenomenon. Well, that can't be tolerated anymore; the stakes are too high. I *know* we're going to see two 747s collide in mid-air, fully loaded, in the next year, year and a half — I just know it — because of the defects I know of in the air traffic control system. And I know more about that, probably, than anyone here at this table. With humility, of course, but I have spent a lot of time . . .

PERLMAN: ABC-type humility.

O'TOOLE: Sixth Avenue humility.

BERGMAN: We're not on Sixth Avenue, kid. We're on Broadway and 66th.

EDELSON: And don't you forget it! (Laughter)

BERGMAN: That's just the headquarters building where they rake in the money. The working troops are up on Broadway and 66th and 64th. Anyway, the more I see how the FAA runs the air traffic control system, the more scared I get. And most frightening of all is that the FAA remains the federal model for effectiveness and responsibility. At a recent news conference, when the Presidential Commission on Three Mile Island turned in its report, I recall Kemeny saying, "We've got to build a single, responsible, executive-type agency that gets things done — like the FAA." Oh, my god.

TECHNOLOGY REVIEW: Much of the demand for "science" articles, it seems to many of us, is really a demand for news and analysis on the applications of science — i.e., technology — and the inevitable social/political/economic issues that both precede and follow the purely technical details. And some would say that a seemingly technical story, like Three Mile Island, is more a political one. How do you, in your own experience, draw the line between

a scientific and political story?

PERLMAN: From my own point of view, and I suspect from those of many others here, there may be two kinds of science stories. The first kind, which has become a little more rare, unfortunately, is a pure science story — written just for the fun of writing it and reading it. I remember being involved in a television discussion with Charles Seeger, a radio astronomer, and Melvin Calvin. Calvin was talking about biology, about changing chromosomes and photosynthesis. Seeger looked at Calvin and said, “You know, that’s the trouble with you biologists: you’re always tinkering with the universe. All we astronomers want to do is observe it. And we want to leave it alone.” And I thought, gee, that was neat, and that’s the kind of story I like to write about. But more and more, I think, most of us find ourselves writing the second kind of science story — what you referred to as a political story — that involves issues that arise out of science and technology. Just look at the prevailing attitude only four or five years ago. I happened to be covering a meeting of the Atomic Industrial Forum, and I attended a private gathering of some of the nuclear industry executives, where Chauncey Starr, then the dean of the UCLA Engineering School [and, until recently, president of the Electric Power Research Institute], told these guys, “The public must accept the judgment of informed experts who have the public interest at heart. The technical issues and trade-offs are so complex that you can’t make decisions in public hearings. If the public wants the benefit of nuclear technology, the public will have to accept the risks.”

O'TOOLE: He wouldn't say it today, would he?

PERLMAN: He wouldn't say it today because it's clearly bullshit. The public is making these decisions — in “complex” hearings on nuclear power and airline safety, for instance — and will, I hope, on everything else.

BERGMAN: But that's not really true. The public doesn't get to make them, that's the problem.

PERLMAN: Well, somehow they have to be made.

BERGMAN: Political agencies make the decisions, and that's another of my favorite bugs. Here we have agencies like FAA, like NRC, which make the

most important sweeping decisions about our safety, the kinds of technology we develop, and sometimes even our science. And who is the chairman or commissioner? — a political appointee! He's good for only a few years. He barely learns where the men's room is before he's out with the old administration. That situation should be changed, I contend.

EDELSON: What you seem to be saying is: it's terrible that the political process is interfering with these technological decisions. If your opinion is taken to its logical conclusion, you're supporting what Chauncey Starr said. What's wrong with a political appointment?

BERGMAN: Nothing, if they make the right appointment.

EDELSON: Well, no one can argue with that.

COOKE: Aren't you saying it's the *quality* of the people, rather than their backgrounds, that counts?

BERGMAN: Sure. Look at Langhorne Bond, who tells me how expert a pilot he is. He has 150 hours and stopped flying three years ago. And his principal achievement in Illinois, where he was secretary of state before coming to the federal government, was the repealing of the motorcycle helmet law. Now that's a contribution to safety, isn't it?

RUSSELL: Going back to the question on science writing and the “line” between science and politics: being in Washington, I probably cover much more politics than science. But I don't think, in any of these issues we're talking about, that you cover just one or the other. In the same way that scientists have a hard time distinguishing basic from applied research, we don't have basic and applied science writing. I think we're always looking at the applications now — the “age of innocence,” in terms of science writing, is over. I started getting into it around 1970, and unfortunately I didn't have that nice period of the '60s when I might have been writing those very optimistic, gee-whiz kind of stories. Basically, I think the 1970s have been *realistic* — not necessarily pessimistic — in terms of being skeptical about science and what its implications might be. That's true of science writers, of the public, and of scientists in general. They have become more realistic about what they say they're going to do and what they



think they can accomplish.

O'TOOLE: Science writing only reflects what's going on with the scientists. And they're all involved with politics — with reality — because of the money involved. The bucks are so big, the stakes are so high, that every scientist who has a program going calls on Capitol Hill to get involved in the politics.

DOWIE: But publishers aren't just looking at what scientists are doing. Publishers are looking for readers. And what readers are interested in becomes what publishers are interested in. The generation that Walter Sullivan is talking about, that grew up in the Vietnam era, doesn't want to read sci-fi science reporting. They don't want to read happy talk about science. They're very interested in the interface between science and technology and even more in the interface between technology and the corporate world, because that's where they see science being abused. That's where science ceases being apolitical. And that's where the myth about science and scientists being apolitical is breaking down. The press is starting to cover science with that reality in mind and that's why people are reading more, I think. Because it isn't happy talk anymore; it's reality.

EDELSON: I don't think we are any more realistic than the last generation was. I think that each particular generation has its myth. In the '60s, it was a happy myth: people wanted to hear good news. Right now, it's an unhappy myth: people in the '70s wanted bad news. Yet by almost every measurable standard, the health and well-being of the American people improved steadily during the '70s. So the point I'm making is that we are now living by a myth about science and technology as much as people did in the '60s and '50s and '40s. Each generation looks back at the past one and says, "Gee, weren't they foolish? We are looking at the world realistically."

RUSSELL: But journalists reflect the mood of the times. We're not going to go back and write a story about a new cancer "cure" the way it might have been written 15 years ago. We're going to be very cautious, having seen what we've seen.

BERGMAN: What is our responsibility, Cris, as science writers? Crash cancer programs, which I'm very bitter about, is a good example. We all sat by



and watched Nixon vie with Kennedy to create them. How many of us blew the whistle on both of them?

EDELSON: I would venture to say that just about everyone at this table either wrote or broadcast something that said we are making a mistake. I know I did.

BERGMAN: I did, too, in a small way. But how can you stop what a president has decided on? What a Congress has decided on?

COOKE: Look at the arms program. How do you stop the MX missile?

RUSSELL: Well, I don't think our function is to be in charge of stopping what we don't like. We are not running the country, but we can lay out the issues.

Reporting or Advocating?

TECHNOLOGY REVIEW: An interesting problem for journalists is how, and whether, to maintain objectivity. This plagues all writers, regardless of their beat, but it's particularly troublesome to science writers because science is supposedly objective — it deals with *facts*. Everyone here would probably agree that there is no such thing as pure objectivity — there is an inescapable political element to every one of our stories. In reporting just "the facts" — the traditional model for journalists in science or anything else — isn't there a built-in bias, or filter, favoring what is safe and easily expressed? And doesn't this produce an overly rosy picture?

PERLMAN: There are some things we can properly do in reporting any aspect of science, the politics of science, or public affairs emerging from science. We can look for self-serving statements. We can expose biases that exist. We can expose lies (scientists lie occasionally, like everybody else, and they're going to lie publicly at times). So that's our job. It's not to say whether nuclear power is bad or good. Present the debate, and be very careful about ascribing expertise to those who are experts — pointing out, for example, that scientist X may be the biggest radiation physicist in the world but he's not necessarily the biggest health-effects expert.

O'TOOLE: You have to let the facts speak for



themselves and avoid playing an advocate's role. You don't have to say, "This is bad."

TECHNOLOGY REVIEW: Sure, but what do you do when there are contradictory views, and conflicting "facts"?

SULLIVAN: That presents a dilemma, because you want to tell your reader the truth. You want to distill, out of all the conflicting arguments, the essence of the problem. I remember, way back, trying to do this on the radioactive fallout controversy, when Pauling was predicting 50,000 malformed children and Teller was saying fallout is good for you. What is really the truth? You certainly start forming your own conclusions, but you are also confronted by the editors, or by your own conscience, so you've got to give the other side, too. So when the American Cancer Society or somebody comes out with new, devastating statistics on cigarettes and cancer, you've still got to call the Tobacco Research Council. They may issue an asinine rebuttal, but you're obliged to present it. You have to let your readers make up their own minds.

RUSSELL: I think, more often than not, we are expected to report information that is simply not available. My editors are often very unhappy when I've written an article, on some controversy or debate, with the bottom line that there really is no answer. We have to report, for example, that nobody knows exactly how harmful low-level radiation is. And then you're talking about the implications — what kinds of political judgments will be made, right now, in the absence of information. If you try to make things more absolute, or try to find people who will tell you "the truth," most likely they're exaggerating it.

EDELSON: I've had the experience of writing a chemistry textbook for freshmen (as a co-author with a college professor). And it's been eye-opening for one reason. You would think that in freshman chemistry there is no argument about the facts. Indeed, there is an argument about almost every fact in the book. It is very difficult to get two chemists to agree on the structure of a basic molecule! Coming out of that, I just don't believe "the facts" anymore. I approach everything with great care now because I

think there are no final answers.

PERLMAN: There's a very significant word that Ed just used. He said, "I approach everything with great care *now*." And one of the things that has made newspaper reporting so interesting over the years is how much we've learned. Cris was referring earlier to treating cancer stories differently now than perhaps one did in the "age of innocence." I think our experiences have lowered our thresholds of suspicion, increased our skepticism, and taught us that the great hopes, new cures, and technological fixes on the horizon haven't proved so foolproof.

COOKE: You mean the experts have been defrocked?

PERLMAN: No, *we've* been defrocked.

RUSSELL: I'll bet no one at this table has used the word "breakthrough" in the last five years.

PERLMAN: Yes, but my paper sure uses the word "fantastic," goddammit.

SULLIVAN: Fantastic means it's a fantasy.

DOWIE: I think we're limiting ourselves here by approaching the whole business of science journalism as being reportorial. More and more of it is becoming expository, and I think that's really important. There's a role for advocacy journalism in science, as well, and I'd like to see more of it.

COOKE and O'TOOLE: Why?

DOWIE: Because I think that everyone is basically an advocacy journalist.

PERLMAN: I disagree. That only applies to editorial writers.

O'TOOLE: I *strongly* disagree.

RUSSELL: I strongly disagree, too. Most of us at this table work for daily newspapers and are trying to be straightforward reporters. Nobody is saying that his or her stories are totally objective or that they don't have opinions. But I don't think any of us is trying to sell a particular viewpoint.

EDELSON: We're all paid to have opinions and to apply them in separating the wheat from the chaff. Most of us try, however, not to be guided by personal prejudice. The difference between that kind of attitude and the advocacy attitude is: Why fight it?

O'TOOLE: Certainly, every time we write a story we have exercised the opinion that this story is



worth writing. But I disagree on the advocacy. And nowhere has it been worse than on the nuclear power issue. Most of the writers in the '60s were pronuclear; most of the writers in the '70s were antinuclear. There's no need for that.

COOKE: And both were wrong.

DOWIE: There is an institution, within journalism, of expository, advocacy writing. And I would like to see science move into that institution rather than that institution necessarily move into science. For example, there is an organization of investigative reporters and editors — a national organization, probably with over a thousand members now — and I don't believe there's a single member who is a science reporter. I think that's a shame.

PERLMAN: You don't have to be a member of an organization of investigative reporters to be an investigative reporter. I think any good reporter is an investigative reporter.

BERGMAN: I'm for fewer groups and more time reading and investigating.

PERLMAN: Tommy O'Toole doesn't belong to the National Association of Science Writers. That doesn't mean he's not a science writer.

O'TOOLE: Did you have to bring that up?

PERLMAN: We want your 45 bucks.

(Laughter)

TECHNOLOGY REVIEW: Is it possible that the word "advocacy" has some very negative connotations — of beating the reader over the head with highly distorted, carefully selected arguments?

EDELSON: Right. You take a point of view and present the facts that support that point of view.

TECHNOLOGY REVIEW: But when Mark says "everyone is basically an advocacy journalist," he probably means you either consciously decide you're going to advocate something or you make that decision unconsciously, by default.

RUSSELL: I think we've all had the experience of writing something, attempting to balance one set of viewpoints against another, and thinking that some of it sounds like pure baloney. Yet some people legitimately believe what seems to you to be nonsense, and afterward they call you up and say what a fair article you've done. But I think it's important,

particularly on very controversial issues, for both sides to feel there was a fair presentation of their viewpoints.

O'TOOLE: You know you've been fair when both sides complain.

COOKE: There has been a tradition of "advocacy" at the *Globe* — to put such a story on the editorial page where the writer *can* have an advocacy role and it's plainly marked.

EDELSON: The important thing is that it be marked. If you're writing a news story, try to write a news story.

DOWIE: That's all I was suggesting. I'm not proposing that Cristine Russell become an advocacy journalist. I'm suggesting that science get onto the op ed pages.

PERLMAN: But it does. I asked Cliff Grobstein [biologist at the University of California, San Diego] to write an op ed piece for the *Chronicle* on cloning. I've asked Sid Drell [deputy director of the Stanford Linear Accelerator Center] to write for us on SALT. Don Kennedy [former commissioner of the U.S. Food and Drug Administration, now provost of Stanford University] is writing a piece now about drug regulation. We do that all the time. We try to get people who have a real basis for doing the advocacy. I wouldn't like to write for *Mother Jones*, for example, although I think it's a hell of a magazine. I read it all the time. But I don't want to be that kind of journalist.

BERGMAN: I agree with Dave. I am flatly opposed to science reporters being advocates. In fact, the older I get, the more years I've been in this business, the more qualifiers I put on stories.

DOWIE: You misunderstood what I said. I did not say that reporters should become advocates. I'm saying there should be more advocacy in science journalism.

BERGMAN: I even challenge that. I want to know where the experts are who'd do that. For example, who the heck could take the Rasmussen report and find that the one-in-ten-million number he used did not include the case of a secondary feedwater cooling system being inoperative (as at Three Mile Island)? It takes three years just to read through it.

COOKE: I think the basic question is: How do we serve our readers? The reader is the guy at the end of the line, and we have to be fair to him.

DOWIE: Some 90 per cent of *Mother Jones* readers are antinuclear — and I know this, as publisher, because I survey them twice a year — so when I decide, with our editorial board, to run a story, we know who we're speaking to. And if the writer is Amanda Spake, or Mark Hertzgard, or another writer who everybody knows is antinuclear, I don't have any problems about that. And we'll be damn sure that the advocacy position is right there in the lead of the story, so that the reader knows what's coming. If you don't want to read it, don't read it. That's all I'm talking about with advocacy. And Mark Hertzgard doesn't have to be an expert in nuclear power. I don't think there is any such thing. He just has to be a good reporter who says, "Here's my position, here are the investigations I've done, here's what Westinghouse says, and I think they're full of it."

EDELSON: There's nothing more comfortable than telling people something they want to hear.

Who Speaks the Truth?

BERGMAN: We in television have a special problem, of course. We don't have a page 74 or 89 like Sully does. Our 30-minute news show — 22 minutes after the commercials and promos — has only one page: the front page. And if I get a story on that — in the midst of the Iran situation, or Afghanistan about to go to war with Russia, or whatever the heck it may be — that's a major achievement. And goddamn, when I'm on I want to be absolutely sure that what I've got is absolutely correct.

TECHNOLOGY REVIEW: Accuracy is certainly crucial in reporting complex scientific stories, and it's important to check with expert sources to make sure you're presenting the facts to your audience. But since professional disagreement on "facts" is so common, who vouches for the experts?

RUSSELL: It's always easier when someone belongs to an official organization or has a prominent title — from Harvard, or whatever. It's more difficult when

you get unknown people calling on the telephone to report they've just discovered such-and-such in physics. We all dismiss a lot of nutty things that come our way, but sometimes — on the laetrile debate, for example, or some other area that is somewhat on the fringes, with researchers and practitioners on the outside of officialdom — you might not want to automatically dismiss what comes along. It is not necessarily wrong or unworthy of coverage.

PERLMAN: What do you think would have happened to you, Cris, ten years ago or even five years ago, if you had written a story suggesting that laetrile was a legitimate enterprise for study by the National Cancer Institute and had advocated that the NCI conduct clinical tests?

RUSSELL: I don't know.

PERLMAN: They would have hooted at you, to say the least.

RUSSELL: I began covering laetrile extensively — going to Mexico, spending time with the advocates — in 1977. It's very hard to cover them, deciding what you will let them say in print and what you won't. In other words, you are constantly making judgments while trying to be fair to the sources involved. But I didn't want to dismiss them out of hand just because the "cancer establishment" might have done so.

PERLMAN: What do you do with Linus Pauling and vitamin C?

SULLIVAN: With Linus Pauling, you report it because it's Linus Pauling. It's legitimate to cover even if it is kooky.

RUSSELL: But most people don't have Nobel Prizes, so it's much more difficult to know what to do, if anything, about covering their unorthodox views. What generally happens is that you get forced into it — after awhile, it becomes obvious that the issue is important. On laetrile, people had been calling me for years before I decided to do something about it.

PERLMAN: Now you can wait for the NCI to come up with the results.

RUSSELL: But at the beginning of that debate, you couldn't just wait until they responded. Pressure had to build before NCI would finally deal with the is-



sue. In a sense, by deciding to cover the case we participated in the process that brought laetrile to the political forefront and made the NCI decide they had to test it.

TECHNOLOGY REVIEW: Professor Wolfgang Panofsky [Stanford University physicist] describes a "profound dilemma" for the scientist: "If he enters the public arena and advocates specific measures relating to the application of science and technology, then he is frequently accused by his colleagues and outside critics of abusing his stature, which he achieved through purely scientific accomplishments, in giving undue prestige to his opinions, which he is simply expressing as a citizen. Conversely, if he remains silent on the applications or possible dangers of the results of scientific work, then he is frequently accused, again by his peers or students or other social critics, of being callous, irresponsible, or immoral." How does a scientist resolve this dilemma — by choosing the lesser, or most tolerable, of the two "evils"?

COOKE: Scientists are much too cognizant of what their colleagues will think. They live in a milieu that frequently binds them so tightly that they just can't get loose. And that's a real danger.

They're Just the Same as You or Me

EDELSON: I think you're making a mistake — an interesting one — that is very common with the public. It is the assumption that scientists are somehow different from the rest of us, that scientists will approach all problems in a logical, scientific way. In fact, scientists are pretty much like us. Some of them are ascetic saints, some are drunken lechers, some do things just to get their names in the papers.

BERGMAN: And some make mistakes.

EDELSON: Some make mistakes at the top of their voices, and so on. We meet them all the time and they're just like us. And yet the going assumption, the unwritten assumption that creeps up on us all the time, is that they are somehow different. Scientists will do the cheap, cowardly thing most of the time because that is what the rest of us would do. That is why people take such great delight when sci-

entists begin fighting with each other.

TECHNOLOGY REVIEW: People think scientists are objective — and therefore different from everyone else — because *science* is supposed to be objective.

EDELSON: Are you kidding? Objective? You give me a scientist; I'll put 50 cents on the table and he will tell me 50 cents' worth of what I want to hear. On the cyclamate issue, for example, all the studies supported by the Calorie Council showed that sugar was terrible and cyclamates were safe; and all the studies supported by the sugar people showed the exact opposite. And these were honest scientists. They were not deliberately setting out to cheat; they just found exactly what they believed they were going to find.

BERGMAN: They found what they were asked to find.

EDELSON: No, no. It's easy to deal with a person who is cheating. These researchers were presenting legitimate, "objective" findings.

RUSSELL: Science was not able to cope with that kind of problem. The population you have to study, in order to establish the chemical as a weak carcinogen, is simply out of the question. So you come up with results — wishy-washy results — that support *both* sides.

EDELSON: Nevertheless, people still regard science, and even more so medicine, as The Great Mystery.

DOWIE: Whenever an issue erupts around which there are strong feelings, you're going to get scientists who are seduced out of their profession, temporarily (or in cases like John Gofman's, almost permanently), to take a position — to leave the objective fold, so to speak — and to be *the* credible witness on one side of the issue. I'm glad scientists do that. I do understand, however, that they're seen as whistle blowers by their peers, as traitors to the high ideals of pure science.

EDELSON: I think you missed my point, which is not that these people abandon objectivity. They do not deliberately say, "Well, I have been an objective scientist, I am now going to become an advocate." What really happens is that scientists are like you and me. I have just finished an article on the

phylogenetics of the flightless birds, for example, in which an enormous amount of passion, vituperation, and outright dirty name-calling has been going on about how closely the kiwi is related to the cassowary. The whole assumption is that scientists are different from us — that they're objective, that they're truth-seekers. They're *like* us. They're liars, they're cheats, they drink, in the same proportions as everyone else.

Lost Innocence

PERLMAN: The difficulty is that we seek certainty, and it's very reassuring, regardless of whether the decision is political or personal, when we believe our information to be certain and foolproof. In that sense, I would agree with Ed that scientists are just like everybody else. They, too, seek certainty. Now maybe I'm naive or overly idealistic, but I think that the tools of science — properly used — can provide a measure of certainty beyond what is provided by pure intuition and hunch. And honest scientists, I believe, spend their professional lives looking for that kind of certainty. But when the scientist becomes a strong partisan and an advocate for a particular position, he begins, like everybody else, to forget about some of the *uncertainty* and accept only that which supports his position. I can recall debate after debate. Hans Bethe [Cornell University physicist] versus Hannes Alfvén [University of California physicist] on the risks of nuclear power is the perfect example — two totally honest and knowledgeable scientists arguing diametrically opposite positions. Another is recombinant DNA, where this same kind of passion has developed and the objective realities that can be discerned in the laboratory have been forgotten.

SULLIVAN: I think those debates showed that science, when it works, works *right*. Participants and spectators finally reached a more rational level of compassion, so to speak. Because when you get one scientific authority debating another, if you're sophisticated enough to follow the arguments, you can pretty soon see who's right and who's wrong. And that's the way science ought to work.

EDELSON: What you're saying is that there is an area of science in which scientists are scientists and then there's an area of advocacy. What I'm saying is that the same lack of objectivity exists in *science*.

DOWIE: On the business of scientists who get after other scientists for taking opinionated positions, I've always read into that, "Don't take an interest in how science is applied." But I really want scientists to take an interest in the applications of their work be-

cause I want journalists to listen to them, to report what those scientists are saying. I'm talking now as a reader, not as a publisher. And, David, you talked about passion. Where do you allow people to become passionate? I mean, great changes are made — political changes, historical changes — because of passion. Now if you don't want the scientists to become passionate, and you don't want the journalists to become passionate, who gets to be passionate on subjects like nuclear power?

PERLMAN: Oh, I want them to become passionate. I'm just talking about where I will go for my sources of information. And we do quote the passionate ones. God knows, I've written an awful lot about John Gofman in my time and would do it tomorrow if he came up with something new to say.

RUSSELL: And this brings us back to the earlier discussion about our roles — whether or not journalists should be advocates. It's clear that the trend in covering science is that we are all advocates, to some degree, for the public's right to know. And if we're going to err, or inadvertently take a side, it's not because we're doing what scientists want us to do but rather that we're trying to inform the public. And to that degree we're all very biased, I think. Coverage of recombinant DNA, for example, was always "biased" toward its possible impact on the public and not toward special interests — be they scientists, or the government, or whatever.

PERLMAN: Before we adjourn, I really would like to touch base at least once more with the "age of innocence." We've been talking about all these heavy things — cancer, nuclear risk, and so on — but there is still a hell of a lot of fun in science. Some scientists may argue vituperatively about cassowaries and kiwis and flightless cormorants, or about the "big bang" theory, but those are *fun* arguments. I want to read you a quote from Harold Urey [Nobel laureate and University of California chemist] that impressed me greatly, a long, long time ago, when I was young and innocent and naive and thought all science was beautiful. This is what he said and it's what got me into science writing: "To those of us who spend our lives working on scientific problems, science is a great intellectual adventure of such interest that nothing else we ever do can compare with it. We are attempting to understand the order of a physical universe vast in extent in space and time and most complicated and beautiful in its detail." If only we could write about science in that context — we'd never have to worry about recombinant DNA, or about nuclear power, or the long-term effects of saccharin — and that's what I'd like to do for the rest of my life. □

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The diamond solitaire.
A jewel that becomes more precious with
every passing year.
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moment last a lifetime.
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The 1/4 carat diamond shown is enlarged for detail. DeBeers.



Diversity in everything
from language and culture to
genetics and technology
is essential if the earth is
to become a sustainable society.

Variety Is the Key to Life

by Paul R. Ehrlich

"In the world of biology, as in the world of finance, diversity is the only protection against the unknown, against a future risk situation." — J. A. Browning

The diversity of nonhuman organisms and the genetic, cultural, and technological diversity of our own species are crucial to the future health, happiness, and perhaps even survival of humanity. Therefore, we must give careful consideration to diversity in human affairs — how it can be maintained and perhaps even regenerated if lost.

The Earth's Public Services

Civilization is utterly dependent upon the ecological systems of the earth for a wide range of essential "public services." These services include: moderating the weather, maintaining the quality of the atmosphere, operating the hydrologic cycle, producing and preserving soils, recycling nutrients, disposing of wastes, controlling more than 95 per cent of all potential pests of crops and causes of human disease, and maintaining a vast genetic library from which come new domesticated animals and plants,

antibiotics, medicines, spices, and organisms for biomedical research. In many cases, the system is not precisely understood, and the know-how to substitute for these services in the event of ecosystem breakdown does not exist. However, in each case, even if the requisite knowledge were available, replacing the services on the vast scale required would be impossible.

The living components of these essential ecological systems are the estimated two to ten million kinds — species — of organisms that inhabit our planet. Most of these organisms are unknown even to science, since they are not yet named and described. Among the millions are such unsung organisms as mites that eat the eggs of plant-eating insects, insects whose populations might otherwise be so large that they would be serious pests. And there are a myriad of tiny arthropods, bacteria, fungi, and other organisms that break down wastes, recycle nutrients, and make the soil fertile. Many such organisms play important roles in complex biogeochemical cycles such as the nitrogen cycle, whose proper functioning is essential to all forms of life. Careful studies have shown how systems of liv-



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ing organisms control these cycles so that, in the absence of gross disturbances, the cycles run predictably year after year. These same studies have also shown the catastrophic consequences, such as nutrient losses, that can result from the disturbance of an ecosystem.

Species diversity — the variety of organisms — is essential for the continuation of ecosystem services. Many roles are performed in the functioning of complex ecosystems; ecologists refer to these roles as “niches.” A niche may be thought of as the characteristic ways in which a component organism obtains the resources it requires. But a species that occupies a given niche in a tropical rain forest may be totally unsuited to play an analogous role in a coral reef.

A great deal is known about the overall organization of ecological systems — the kinds of niches, broad energy paths, gross nutrient inputs and outputs, and so forth. For example, major ecosystems can be divided into a series of trophic — feeding — levels. On the first trophic level are organisms that are principally producers — green plants that bind the energy of the sun into organic molecules that fuel the life processes of other plants, animals, and microorganisms. This binding process, photosynthesis, is reasonably well understood, but we have not yet been able to reproduce it. Energy and nutrients flow from producers to the next level, herbivores, and then on to carnivores.

One critically important trophic level is the decomposers — small plants, animals, and microorganisms that make their living by extracting energy from the chemical molecules of the remains and wastes of other organisms. In this process, free nutrients are once again taken up by plants and recycled in the ecosystem. Energy proceeds through ecosystems in a one-way flow in which the availability of the energy to run life processes is continually and rapidly reduced. Materials, on the other hand, tend to move in cyclical paths through ecosystems.

While this “black box” structure of many ecosystems is known, the details of how the component species interact and evolve are not well understood. We know that niches are not static; they are always in flux as population sizes vary and species are transformed genetically. But we do not often know how to predict these changes or their consequences for an entire system. Indeed, trying to understand a natural ecosystem is like trying to unravel the complexities of a gigantic computer that someone else has built

and that cannot be disassembled for study. The problem is especially difficult because the numbers as well as the characteristics of each ecosystem component are continually changing in response to changes in all the other components. As a result, the importance of diversity of organisms to ecosystem stability has become one of the most widely debated topics in population biology.

Though we don’t fully understand how the earth’s ecosystem functions and regulates itself, we do know it is essential to human life, so ecologists tend to take a dim view of disrupting the system’s many components. While it’s true that removing certain components and altering others may not lethally disrupt a system, in most cases we cannot say what can be safely disturbed. Indeed, the only accurate prediction possible is that if enough components are deleted or altered, eventually the entire system will collapse.

Considerable attention has been drawn to the potential economic value of many species that are being driven to extinction. Almost half our modern drugs have natural origins in plants, and yet only a tiny minority of plants have been screened for possible medical usefulness. Conservationist Norman Myers, writing only of the tropical forests, says there is “a statistical certainty that [they] contain source materials for many pesticides, medicines, contraceptives and abortifacient agents, foods, beverages, and industrial products.” The potential of using alkaloids — a single group of botanical chemicals — from tropical plants for the treatment of diseases ranging from hypertension to cancer might alone be more than enough to justify the preservation of Amazonia, African forests, and the remnants of tropical forests elsewhere.

Compelling as these reasons are for preserving species diversity, they are second to the need for diversity to assure the maintenance of ecosystem functions. Society could persist without new pesticides and anticancer chemicals; it might not survive widespread breakdown of biogeochemical cycles, rapid climatic change, collapse of ocean fisheries, or other catastrophic ecosystem losses.

A Genetic Footrace

Not only is it important that species be preserved, it is important that genetic variability *within* species be saved. Genetic variability is essential if a species is to evolve. Since environments are always changing, genetic variability is essential to the preservation of



WE NEED ANOTHER AND A WISER AND PERHAPS A MORE MYSTICAL

CONCEPT OF ANIMALS.

Remote from universal nature, and living by complicated artifice, man in civilization surveys the creature through the glass of his knowledge and sees thereby a feather magnified and the whole image in distortion. We patronize them for their incompleteness, for their tragic fate of having taken form so far below ourselves. And therein we err, and greatly err. For the animal shall not be measured by man. In a world older and more complete than ours they move finished and complete, gifted with extensions of the senses we have lost or never attained, living by voices we shall never hear. They are not brethren, they are not underlings; they are other nations, caught with ourselves in the net of life and time, fellow prisoners of the splendour and travail of the earth.

From *The Outermost House* by Henry Beston. Made available for The Fund by Judge William Newsom.

any species. The problem of the loss, or decay, of genetic variability has received most attention in connection with crops.

In nature, plants are engaged in a continuous stepwise evolutionary battle with plant diseases and herbivores. Plants' enemies are always evolving new methods of attack to counter the constantly evolving defenses of the plants themselves. Likewise, crops are involved in a "co-evolutionary race" with the pests and diseases that attack them. A resistant crop strain will produce high yields only until one of its attackers evolves a way to overcome the resistance.

With domestic plants, however, it is up to plant geneticists to create new, resistant strains. The raw material the plant breeders must use is genetic variability — variability that was once abundant in the multitudinous strains of crops that were planted all over the world, and in their wild ancestors. But in recent decades, in part as a result of the "green revolution," the number of crop strains has been greatly reduced. In some areas of Turkey, for example, numerous varieties of wheat used to be planted. Now only one "miracle" strain can be found.

In 1972 a committee of the U.S. National Academy of Sciences concluded that "most major crops are impressively uniform genetically and impressively vulnerable." At the same time, habitat destruction and chemical herbicides have reduced the availability and in some cases even threatened the existence of the wild relatives of crop plants. This decay of real and potential variability of crops is one of the least recognized but most important factors in the deterioration of the human environment. If it goes too far, *Homo sapiens* will be permanently out of the business of high-yield agriculture which, with the present world population, would be an unprecedented catastrophe.

While the decay of genetic variability in crops and, to a lesser degree, in domestic animals is now gaining attention, the parallel problem in wild species has been largely ignored. In the minds of many, conservation simply means preserving *species*, which in turn means keeping a minimum population of a particular organism extant. But every population represents a potentially unique gene pool, adapted to local conditions. Each time such a population is driven to extinction, the ability of the entire species to persist is jeopardized, both because the species population is reduced in numbers and geographic distribution, and because the total genetic variability theoretically available to the species is reduced.

(Continued on page 64.)



Playing God to Save Diversity

by Norman Myers

Extinction has been a fact of life since life began — less than 10 per cent of all species that have ever existed are alive today. Now, however, the destruction of natural environments is accelerating at such a rate that creatures everywhere are running out of living space. The consensus among ecologists, taxonomists, and other scientists is that we are losing one species per day. Still, if a few more species go under, does it matter? If, at the end of 1980 we find that the snail darter is no longer with us, the earth will keep on spinning.

To this, some conservationists respond that every species has a "right" to exist. Each species represents a separate manifestation of life's diversity; its extinction is an irreversible alteration, and — given that species are

now being eliminated far faster than new ones are coming into being — an impoverishment of the fabric of life's processes. The main argument given by such conservationists for preserving a species is, simply, that it is there — a unique entity that humankind should not casually cast into the abyss on the grounds that we can no longer share space with it on our one earth home.

What of this ethical "right to exist"? Put another way: Do we have any right to cause the extinction of species if we can avoid it?

Yet we do not even profess to value all forms of life equally. Most of us would be glad to see the end of the virus that causes the common cold. And what about organisms that contribute to cancer? Yet these are unique forms of life with just as much "right" to exist as the giraffe or the whooping crane. Smallpox virus no longer causes human suffering; it exists only in the laboratory. Should we by conscious and rational decision obliterate this manifestation of life's diversity?

It is equally unrealistic to state that each particular species represents an absolute value that cannot be traded off against other values. The U.S. government has spent several million dollars over two decades or more to safeguard the whooping crane. Since the citizenry does not riot on Capitol Hill in protest, it is reasonable to suppose that society goes along with these outlays. But suppose the cost of preserving the crane were several million dollars a year, or a billion dollars a year? At what point would even the keenest conservationist protest?

In fact, virtually nothing, not even human life, is considered by society to be absolute. True, each individual views his or her life as an untradeable asset. But as a member of society, he or she does not view human life in

general as an absolute. The number of road-accident deaths each year — 55,000 in the United States, 110,000 in Europe, and over 225,000 worldwide — amounts to an appalling loss of life, yet it is considered by society to be an "acceptable" price for rapid transportation.

The Absolute Commitment to Diversity

Presumably there is only one absolute value and that is the survival of life on earth. To this absolute value species make an absolute contribution; when there are no species left there will be no more life. But not all species make the same contribution. The value of a species, far from being absolute, is very much a relative affair.

Especially difficult is the relative value of human life and the life of other species. In many places where people compete with wild creatures for living space, the conflict is already obvious. This conflict is going to get worse, and fast. It raises complex ethical issues that deserve in-depth treatment, but suffice it to say that many conservationists could probably accept the elimination of a species if it could be demonstrated that the creature's habitat would produce crops to keep huge communities of people alive. (Provided, of course, that the food could not be grown elsewhere, that the people

could not find any other means to sustain themselves, and that the species could not be relocated.) If the situation were reduced to weighing the survival of one species against that of several million people, it might well be viewed as a tolerable, if regrettable, tradeoff.

But the prospect facing humanity in the next few decades is not so clear-cut. To allow expanding numbers of people the living space they think they need, at least one-fifth, possibly one-third, and conceivably one-half, of all species on earth may well be driven to extinction within the next half-century or so. Is this rash of extinctions in our best short-run interests; let alone those of generations to come?

In view of the direct benefits to medicine, agriculture, and industrial materials of species' genetic resources, it is certain that humankind will suffer greatly from the disappearance of, say, one million of the earth's five to ten million species. In 1960, a person with leukemia had one chance in five of survival; in 1980, the outlook is four chances in five. This remarkable change stems in part from the discovery that a tropical forest plant, the rosy periwinkle, contains alkaloidal material with powerful antileukemia properties. Sales of periwinkle-derived drugs now total \$35 million per year.

Scientists have systematically screened for usefulness only 1 per cent of the earth's species so far. Even this limited screening has resulted in the discovery of many thousands of materials that contribute daily to our welfare. When we go to the pharmacy to buy medication, there is a 50 per cent chance that what we buy derives from materials of natural origin. If so far in 1980 we have lost 100 species, who is to say that there was not another rosy periwinkle among them?



Extinction: By Design or Default

How do we respond to the dilemma of disappearing species? Even if we were to consider taking out an "insurance premium" against the repercussions of losing one million species, it is doubtful that we could afford the vast sums required to halt the disruptive economic forces that destroy habitats, gathering momentum with every tick of the clock. Meanwhile, conservationists must make do with very limited resources. Even with a several-times increase in present resources, conservationists could not assist more than a small fraction of all species that appear doomed to disappear. Since we are intervening in evolutionary processes with an impact similar to that of major glaciation, we should do it with as much awareness as we can muster. But how to accomplish this? If we cannot be sure of the details, can we at least establish the right direction to move in?

How are we to decide which species shall be allowed to become extinct so that we can concentrate our conservation efforts on "more-deserving" species? Certain species would simply disappear if we pulled the carpet out from under them. We could start by asking whether it makes sense to keep spending almost \$20,000 a year on what is considered the most endangered bird on earth, the Mauritius kestrel. There are only nine individuals left in the wild and about a dozen in captivity. Apart from the doubtful prospects for the creature's recovery, there is a closely related kestrel on the

African mainland that flourishes with a population of many thousands. So we might abandon the Mauritius kestrel to its all-but-inevitable fate and utilize the funds to provide stronger support for any of the hundreds of threatened bird species that are more likely to survive.

In short, a proportion of species will disappear through human design. Agonizing though this might be, it is better than allowing species to disappear merely through human default.

An approach along these lines would amount to a "triage strategy" for species. But how to choose between the Bengal tiger and a crab in the Caribbean? Should we focus on remnant patches of rain forest in countries that have experienced decades of destruction, or should we try to "lock away" vast tracts of forest in regions that have been little touched? These are difficult decisions. Systematic analysis of the factors rendering some species more susceptible to extinction than others would be a start. One such factor is poor reproductive capacity — a pair of ants reproduce much more quickly than a pair of rhinos. In addition to biocological factors, we must consider economic, political, legal, and sociocultural aspects of the problem: the Bengal tiger requires large amounts of living space in an area that is crowded with human beings. Still, a campaign to save the tiger could stimulate more public support (and also help save many other species) than a campaign on behalf of a less-than-charismatic creature such as a crab.

Since we are now committed to playing God on a large scale, we might as well do it with as much selective discretion as we can muster.

Norman Myers, Ph.D., a conservationist living in Nairobi, Kenya, is a senior associate of the World Wildlife Fund. His latest book is The Sinking Ark (Pergamon Press, 1979). □

The best plan
for a global sustainable society
is not to model the whole thing
after a mix of the
Los Angeles basin, Tokyo,
and the Ruhr.

Indeed, the ability of *Homo sapiens* to evolve genetically ultimately depends on the species' store of genetic variability. Fortunately, as with most sexually reproducing species with enormous population sizes, there seems to be no need for concern about *Homo sapiens*' store of genetic variability; for the present we are not at all short of the raw materials of evolution. But should we suffer a catastrophic reduction in numbers, care would be needed to maintain even *our* genetic variability.

I say "fortunately" because at the moment not enough is known by population geneticists to make sensible recommendations about manipulations of the human gene pool. There is controversy, for example, over what proportion of human genetic variability is among populations and what proportion is within populations. It is also unclear how much genetic variability contributes to many individual human characteristics, including such controversial traits as intelligence, creativity, and mental illness. Our present knowledge of human genetics allows for only the most limited advice — such as counseling parents about the probabilities that their children will inherit certain genetic diseases or warning that increased exposure to radiation or mutagenic chemicals is likely to be harmful.

As long as there are billions of people living in diverse situations, there is no reason to be concerned about the richness or quality of the human gene pool. Should a thermonuclear war reduce *Homo sapiens* to a few scattered groups of survivors, that statement would no longer apply — but it seems unlikely that many population geneticists would survive to worry about it.

Culture Is Important, Too

While there appears to be no reason for immediate concern over the genetic diversity of *Homo sapiens*, there clearly is a need for immediate attention to humanity's *cultural* diversity. Just as genes are the raw material of biological evolution, so can nongenetic information — culture — possessed by individuals and societies be thought of as the raw material of cultural evolution.

By some measures, the body of cultural information is growing exponentially. Consider, for instance, the explosive growth of science and technology in recent decades and the computer revolution that so enhances our ability to manipulate and store information. In other ways, however, humanity's store of cultural variability is clearly erod-

ing. A Western, industrial-scientific culture is overwhelming and replacing the wide variety of human cultures that existed a mere 50 years ago.

One world view and one family of languages are becoming increasingly dominant, and the speed with which that dominance is being attained is increasing. One of the last major holdouts against Westernization, the People's Republic of China, with nearly a quarter of the globe's population, shows distressing signs of giving in. With Coca-Cola already in and the plea out for Western technology, can English as a second language be far behind?

Unfortunately, while too little is known about the process of genetic evolution, even less is known about the process of cultural evolution. On the basis of this meagre knowledge, however, it would seem wise to take a conservative position on the preservation of cultural resources for the same reasons that commend a conservative approach to the preservation of biological diversity. There is, for example, no guarantee that the secret for human beings living in peace with one another is not buried deep in the culture of, say, the gentle Tassaday of the Philippines. Once everyone is Westernized we will never know.

Technological Diversity

Finally, it can be argued that there is much merit in maintaining a high level of "technological diversity" — diversity in the physical and social technologies employed by human beings in general and Western nations in particular. If people can use many different means to achieve the same ends, the benefits are manifold. Physical decentralization of technologies reduces vulnerability to accidental or malicious disruption. Social systems become less susceptible to massive subversion. Individuals gain more control over their lives and are more likely to reap the benefits (and pay the costs) of their own acts. Diversity and decentralization permit, in essence, parallel experiments on the advantages and disadvantages of different systems.

The most thorough arguments for technological diversity and decentralization have been made by Amory Lovins in his classic works on "soft" energy paths, and by plasma physicist John Holdren in his cogent discussions of the need to design systems that localize both the costs and benefits of power generation in the same population.

It seems wise to encourage as many parallel and semi-isolated experiments as possible, not only to maximize the yield of information but also to limit

the spread of breakdowns. Consider how much better off the United States might be today if, in the early part of this century, we had encouraged some cities to use mass transit for commuting, others to design around bicycles, and still others to plan so that people could walk to work and commuting would be unnecessary. Today's urban and energy problems would then be much closer to solution.

On a grander scale, suppose that cultural barriers had been stronger. How much better off might humanity be today if its future political-economic choices included dozens of distinct systems rather than being constrained to variants of just two? This restriction in choices is especially tragic since both capitalism and communism may be incapable of solving our most important problems.

Of course, humanity is neither inclined nor organized to carry out such experiments. But are there courses society can select that will permit the maximum diversity to be preserved?

Zoos Are Not the Answer

The way for humanity to preserve biological diversity is simply to reduce its now escalating assaults on the ecosystems of the planet to a level where natural resilience can easily permit accommodation. As long as these systems are being paved over, plowed under, and subjected to chemical warfare with everything from acid rain to PCBs, rapid deterioration of diversity will continue. The solution boils down to converting much of the remaining relatively undisturbed habitat into preserves where human activities are minimized and carefully regulated.

Some progress has been made by population biologists in conserving the maximum of diversity per unit of area set aside. However, in most cases the best rule to follow is to maximize the preserve area. Judgments of minimum preserve size made on the basis of information gathered in the relatively short term may be utterly wrong. For example, during the California drought of 1975-76, some preserves in that state were too small to prevent the extinction of some insect populations — even though before the drought the areas seemed quite adequate.

There is a growing tendency for people to consider the maintenance of animals in zoos an appropriate method of preserving diversity. One notion is that species thus protected from extinction could eventually be used to "restock" nature after a secure habitat is reestablished. There are several serious defects in this reasoning. First, the resources of the

world's zoos are completely inadequate to the task — and there are few signs that additional resources will be forthcoming to maintain even a small fraction of the vertebrates soon to be endangered. More important, animals kept in zoos are quickly selected for docility and other characteristics that make them easy to keep in captivity — characteristics that make them utterly unadapted to the wild.

But, of course, the ultimate folly of the “preserve-them-in-zoos” school is the belief that once endangered species (now mostly mammals and birds) are ensconced in zoos, the habitat they have vacated will be preserved (or eventually restored). In fact, prominent endangered species are often the sole factor in retarding the forces of development in a given area. Could anyone seriously argue that if California condors were said to have been successfully preserved in zoos, anything could protect the condor preserves in Southern California? Highly visible endangered species are very often the key to preserving habitats for myriads of less well known but potentially even more important organisms.

Preserving Genetic Diversity

Genetic diversity of crops could be maintained — much more easily than species diversity — with three practical actions. First, adequate biological preserves must be set up so wild relatives and progenitors of crops will be automatically protected. Second, the development and deployment of genetically highly variable crop strains that show high resistance to both pathogens and insect pests must be accelerated. And third, a series of agricultural research stations around the world should be founded specifically for genetic work essential to maintaining crop diversity. Seed storage is inadequate, since the storage process selects for seeds that store well and itself may produce genetic damage. But if the stations had funds for maintaining experimental fields and subsidizing local farmers to plant less productive varieties, the crucial problem of maintaining crop variability could be solved. The price would be minuscule compared to the arms budget of even a second-rate military power.

Stop the Melting Pot

Preserving human cultural diversity, even in theory, is much more difficult. A biological preserve system might help, since indigenous peoples could be “preserved” along with their natural habitats. But

virtually all societies are now more or less in full contact with Western society, and putting people into cultural “zoos” presents great practical and moral problems.

To give a single example, suppose that a large section of Amazonian rain forest along with the Indian peoples inhabiting it were permanently set aside. Would the Brazilian government then have the moral right to prevent doctors from entering the area and bringing Western medicine to the Indians? Would it be physically possible to do so? I am inclined to answer yes to the first question and no to the second, but humane people are bound to disagree on these points. If a decision were made to introduce Western medicine, then not only would the cultural distinctness of the Indians fade, but unless contraception were introduced simultaneously, their population would probably increase to the eventual detriment of the biological preserve. Sadly, it seems certain that the few remaining “primitive” peoples will undergo substantial acculturation — or disappear.

The prospect for preserving cultural diversity in *Homo sapiens* is not entirely bleak, however. Many people have been distressed to see the goal of “one world,” which so many hoped was close after the Second World War, seemingly move further from our grasp. Ethnic and religious distinctions appear to be strengthening rather than diminishing. Many Francophones want to secede from Canada; many Black Power radicals reject the goal of assimilation into a white society in North America; the Ibos, Hausas, Masai, Kikuyu, and other African tribes maintain strong senses of ethnic identity.

People clearly have difficulty relating to a vast, amorphous world culture. The desire to identify with a more restricted group creates countervailing centrifugal forces that keep everyone from being sucked into the same cultural vortex. One viable strategy for attempting to maintain cultural diversity, then, is to work with those forces that are already present.

The West, in particular, must overcome the idea that there is something wrong if Iranians prefer to live under a repressive religious ruler rather than suffer forced Westernization under an even more repressive shah. Americans should not be amazed that French-speaking Canadians might wish to retain their cultural traditions and their beautiful language even at the cost of some difficulty in air traffic control and some economic disruption. A middle-aged corporate executive sequestered in a coronary in-

tensive care unit might grow to appreciate a relaxed Polynesian culture. He might even realize that the lives of Australian aborigines or Masai tribes would not necessarily be enhanced by dressing those proud people in Western clothes and putting them to work in office buildings. In short, the world could come to learn that a high price is paid for the "creature comforts" of industrial civilization and that these benefits are very unevenly distributed within the West. The best plan for a global sustainable society is not to model the whole thing after a mix of the Los Angeles basin, Tokyo, and the Ruhr.

Indeed, some who have thought extensively about sustainable political systems see the maintenance of cultural diversity as a key element. It is generally agreed that some form of redistribution of wealth will be necessary for a successful transition to a sustainable society. Today the rich minority is attempting to "buy off" the poor majority by promising that future growth will enrich even the poorest of the poor. That result is doubtful even if the requisite growth were possible or desirable; in the absence of substantial continuing growth, that promise becomes transparently absurd. Yet faith that some type of redistribution will be possible is essential to maintenance of the social contract.

It is hard to avoid the conclusion that nothing less than a restructuring of Western ideals and values will be required if a satisfactory redistribution is to be achieved. A demand must be created for the cultural and other resources that can be supplied by nonindustrialized peoples. People must accept that not all areas can be industrialized or even economically productive in conventional terms. Today some areas within Western countries are maintained at economic expense because they supply other values — certain parts of the United States, for example, are preserved as parks or wilderness. Similarly, some areas and peoples of the globe should be maintained at economic expense because they supply other values: cultural diversity, biological diversity, natural beauty, survival and happiness for other human beings, and, in the long run, survival for everyone.

The notion that substantial progress can be made in that direction is, to a degree, utopian. But so, today, is the notion of moving toward a sustainable society. And many of the steps that might help slow down cultural homogenization are those that most thoughtful people recognize as necessary if a sustainable society is to be approached.

Western nations promote their culture and technology in other parts of the world for economic

reasons — they seek ever expanding markets. If the push for economic growth were eased, the whole process of Westernization would slow considerably, and we would have some chance of preserving cultural diversity.

Some preservation of technological diversity will obviously result if successful steps are taken to preserve cultural diversity. But the reverse is also true. For example, population biologist Peter H. Raven has eloquently advocated a commitment by the United States to assist poor nations in developing solar energy as a major route toward economic stability and prosperity. Solar technologies vary widely; many can be constructed with local labor, adapted to local conditions, and designed to require little capital compared with other technologies. They do not require permanent conduits to technological centers of the West, in stark contrast to "hard" energy systems such as nuclear.

A transition to a diverse array of renewable (primarily solar) energy technologies would also make rich nations much less vulnerable to interruptions of supply due to accident, terrorism, or political manipulation. Since energy plays such a fundamental role in all technological ventures, diversification of energy systems should have top priority. Transportation is another obvious area where technological diversification is desirable. Dependence on petroleum-powered vehicles — both trucks and passenger cars — must be reduced.

Regenerating Diversity

With present — or foreseeable — technologies, species and populations can be reestablished in some areas where they have become extinct, and thus species diversity may be partially restored. For example, the large copper butterfly *Lycaena dispar*, extinct in England, has been reestablished in a small area using stock from Dutch populations.

In most cases, however, extinction results from habitat destruction, and therefore even limited regeneration is often impossible. Of course, once all the populations of a species have been extirpated, the situation is irreversible. Furthermore, many human activities tend to disrupt the speciation process, the natural evolutionary mechanism that for billions of years has created new species and compensated for natural extinctions. This development is ominous indeed since humanity appears to have increased extinction rates by an order of magnitude or more over historic rates.

The picture is not quite so bleak with respect to genetic diversity since appropriate breeding programs can increase the frequency of rare genes. When genes have been entirely lost, however, we must wait for random mutation to recreate them. The wait may be very long indeed (although in some cases mutation rates can be accelerated) because many, if not most, desirable traits appear to have a complex genetic basis involving many interacting genes. But usually the individual genes cannot be detected, so that in practical terms, once a trait is lost through the decay of genetic variability, it would reappear only if several beneficial mutations occur simultaneously — an extremely improbable event.

Cultural diversity might be regenerated in various ways short of deliberately cutting off all communication among human groups and waiting for the inevitable divergence. In nations like the United States, this might involve weakening the central government and fostering regionalism by encouraging people to live their entire lives in one place.

Still, cultural diversity, too, is clearly easier to preserve than to regenerate. Only with technological diversity is regeneration easy in principle, usually requiring only the political will and capital. The United States, for example, could move to a transport mix in which trains, buses, bicycles, and feet were all more important than private automobiles. This would require only political courage and some temporary economic dislocation, but not as much as usually imagined.

The Snail Darter Is Important

Working toward a steady-state economy would automatically be a major step toward the preservation of diversity. However, this is unlikely to be enough. The transition to a worldwide steady-state economy will occur over a relatively long term — many decades at the least. During that transition, the decay of variability is certain to accelerate. It may reach levels that will eventually greatly lower the earth's carrying capacity for human beings while also reducing the cultural resources of *Homo sapiens* to deal with that lowered capacity. The fact is that the fate of Western civilization is likely to be influenced by the fates of small organisms such as the snail darter and obscure peoples such as the Tassaday. Much more must be done to impress this fact upon people in general, and decision makers in particular. Emphasis should be shifted away from the preservation of wilderness areas for recreation and esthetics (though

both are perfectly valid) and toward their role in preserving the life-support systems that make civilization possible. Those who wish to see other cultures and peoples preserved on compassionate grounds should also make the case that preservation is in everyone's self-interest.

A sustainable society should be one in which nature's economy is monitored as closely as the conventional economy. Considerable effort may be necessary for ecosystem preservation and restoration, and the diversity of cultures and technologies should also be nurtured with care. Fear of loss of human diversity must override xenophobia. Fear of putting too many eggs in one basket must override the economic and political forces of centralization.

Humanity now finds itself in an ironic situation. The only practical solutions to its major problems are unrecognized or shunned by most practical people. But nothing could be more impractical than for society to continue on its present course.

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This article is adapted from Professor Ehrlich's paper "Diversity and the Steady State," which was awarded the Mitchell Prize for 1979 by the Woodlands Conference. The full paper will be published in a forthcoming book, *Quest for a Sustainable Society*, James Coomer, ed. (Pergamon Press).

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Trend of Affairs

Trends This Month

Living 70

Runners: running toward or away from good health? . . . When a house may not be a home . . . How safe is food? . . . Who favors the flavor of fabricated foods?

Petroleum 73

U.S. oil industry plans all-time high in domestic shafting . . . Needed: a better mop for Caribbean oil spills . . . Oil greases the way for stagflation.

Human Reproduction 76

Sexist presexing of offspring in the offing? . . . Hazardous chemicals: nondiscriminatory threat to reproduction.

Living

Marathons and Coronary Health

About 25 million Americans run regularly, and about 80,000 elite runners participated in more than 300 26.2-mile marathons in the U.S. last year. Does all that running confer good coronary health or does it increase the risk of heart disease and early death? Epidemiologists are hard-pressed to respond.

Moderate physical activity and good coronary health are clearly associated. In a recent study of 16,936 Harvard University alumni, Dr. Ralph S. Paffenbarger, Jr. and colleagues at the Stanford University School of Medicine found that the relative risk of first heart attack was significantly less for active than for inactive alumni (see table). They conclude in the *American Journal of Epidemiology* that "the persistent corroborations encountered in these data strongly support a protective role for vigorous exercise in the reduction of heart attack risk."

They note other epidemiological studies that associate good coronary health with physical activity among longshoremen, lumberjacks, railroad workers, bus drivers, and college students. Such conclusions serve to recommend some level of regular physical activity for warding off coronary problems, but how much is enough? Put another way, if jogging is therapeutic, is marathoning even more beneficial?

Dr. Thomas G. Pickering of the New York Hospital-Cornell University Medical

Center in New York focused on that question in the *American Journal of Medicine*: "As with all new fads, extravagant claims have been made for [marathoners'] benefits. Cardiovascular disease continues to be the most important cause of death in the U.S., and most of the controversy has centered around the effects of marathon running on the heart." Dr. Pickering pointed out several biochemical mechanisms through which regular physical training can reduce the risks of coronary disease:

□ Marathon runners "constitute a low-risk group for reasons other than physical activity. . . . They tend to be highly educated, lean nonsmokers who are free from other disorders such as hypertension."

□ Subjects judged to be "physically fit" in treadmill tests have "lower levels of cholesterol, triglycerides, blood glucose, uric acid, blood pressure, and body fat" than unfit subjects.

□ Physical training raises the plasma levels of high-density lipoprotein, a desirable substance that is associated with good circulatory function (reported also by Dr. G. H. Hartung et al. in the *New England Journal of Medicine*).

But the benefits of marathoning are more controversial. For example, "it is biologically impossible for atherosclerosis [a disease in which fatty deposits accumulate in and block the flow of blood



Chart: The results of a 10-year study in which 16,936 Harvard University alumni, aged 35 to 74 years, were classified according to five measures of physical activity and prevalence of heart attack. According to the researchers, the relative risk of first heart attack was "related

inversely to energy expenditure" by the values given in the right-hand column. (Source: Paffenbarger, Wing, and Hyde in the *American Journal of Epidemiology* 108, 3 [September 1978].)

Photo: Boston Marathon start (Arthur Grace/Stock, Boston)

through arteries] to progress in anyone capable of even walking the 42-kilometer distance," says Dr. T.J. Bassler, a marathoning pathologist at Centinela Hospital in Inglewood, Calif. An outspoken proponent of marathoning, he has made such claims in *Physical Sports Medicine*, *American Heart Journal*, and the *Annals of the New York Academy of Sciences*. But he opened up his contention (a "notorious claim," says Dr. Pickering) to direct refutation in the *New England Journal of Medicine* when he wrote: "Until there is autopsy evidence of fatal atherosclerosis among marathon runners, it seems prudent to advise this lifestyle for the prevention of this disease."

Such evidence was provided by Dr. Timothy D. Noakes and colleagues at Groote Schuur Hospital, the University of Cape Town, and the National Hospital at Bloemfontein, South Africa. In the *New England Journal of Medicine* they described clear evidence of the disease — in one case directly fatal — in the autopsies of four male marathon runners: a 44-year-old nonsmoker and nondrinker who died during a marathon; a 41-year-old ex-smoker who ran as therapy after a massive heart attack (although forbidden by his physician to run marathons) and who died in hospital awaiting a coronary bypass operation after a second attack; a 36-year-old ex-smoker killed while running by an automobile and proved to have advanced atherosclerosis; a 27-year-old killed with the previous runner in the same accident, who was an "active athlete" and smoker and who proved to

Physical activity in 1962 or 1966	Person-years of observation	Number of people with heart attacks by 1972	Relative risk of heart attack
Stairs climbed daily:			
Less than 50	37,946	222	1.25
More than 50	76,064	329	1.00
City blocks walked daily:			
Less than 5	24,996	140	1.26
More than 5	85,345	385	1.00
Light sports play:			
No	66,638	288	1.08
Yes	45,724	102	1.00
Strenuous sports play:			
No	66,638	390	1.38
Yes	45,724	148	1.00
Typical activity index (kilocalories per week):			
Less than 2000	56,459	307	1.64
More than 2000	38,027	122	1.00
Undetermined	23,194	143	—

have advanced atherosclerosis.

Drs. Drummond Rennie and Norman Hollenberg, editors of the *New England Journal of Medicine*, put the running/coronary health controversy into as clear a perspective as is possible with the available data: "We . . . point out that physicians who recommend ambitious exercise programs for their patients must re-

member that proof that this approach will prevent or even delay cardiovascular death is not yet available." Their recommendation: "Until the [needed diagnostic] data are in, the exercisers' enjoyment of the activity and their pleasure in the way they feel and look should be sufficient. In exercise, as in good deeds, the reward must lie in the act itself." — L.A.P. □



Discrimination in the Housing Market

Despite increasing pressure from federal and state laws, racial discrimination is still "widespread" in suburban housing, says Robert Schafer of the Joint Center for Urban Studies of Harvard and M.I.T.

The analysis leading to this conclusion is not simple. No two houses are alike, and many subtle values — other than the race of the buyer and the neighbors — enter into pricing. Mortgage decisions, too, are affected by countless factors in which the role of discrimination is unclear. One of these is "red lining" — the denial of mortgage credit or preferential treatment of mortgage applicants because of race in a geographical area.

But despite the difficulties in analysis, Mr. Schafer is convinced that blacks pay more than whites in almost all real estate markets in the Boston area. And in these

markets, he says, whites "are willing to pay more for otherwise identical housing located farther from black residence areas."

These data are consistent with analyses of others: in Chicago blacks pay 10 per cent more than whites for real estate in largely white areas and 17 per cent more in boundary areas between black and white neighborhoods; and in St. Louis nonwhites may pay up to 50 per cent more than whites in racially mixed neighborhoods.

Analyzing New York State data, Mr. Schafer concludes that "most mortgage lending is based on objective factors." But his results "are consistent with allegations that at least some savings banks discriminate against minority applicants" in the Buffalo, New York-Nassau-Suffolk,

Rochester, and Syracuse areas. In these and other cases of mortgage discrimination, the racial composition of the neighborhood is less important than the race of the individual applicant.

The problem results mostly from regulatory agencies' failures to enforce existing fair housing laws. Mr. Schafer calls for more resources devoted to enforcement, including better record keeping by banks and savings associations. — J.M. □

Who Decides What We Eat?

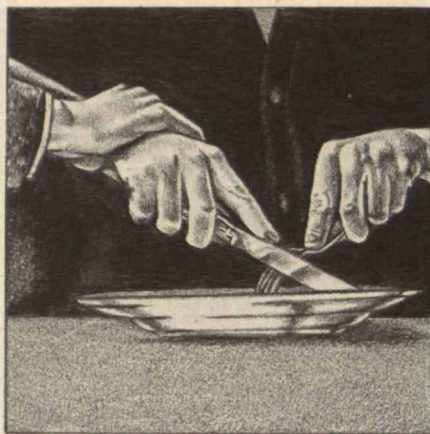
The average person reading newspapers and magazines over the past few years may have concluded that everything we eat causes cancer. While this statement isn't true, almost everything we eat — every biologically active molecule — can probably be shown to be harmful in one way or another, according to Sanford A. Miller, director of the Bureau of Foods for the U.S. Food and Drug Administration. He addressed several hundred food scientists at an award ceremony held at M.I.T. this fall.

What should the consumer do? And how much could, or should, the government do to insure food safety?

"How far will people allow government intrusion into personal choices?" was the way Dr. Miller put it. "The American people have been pushed to a position in which they are cynical and distrustful of all public institutions and activities," Dr. Miller told the *Boston Globe*. He added "These concerns focus largely on food because food is such an intimate part of an individual's existence, and more importantly, it is one of the few aspects of an individual's life that he or she can control."

One of the thorniest questions comes when a substance has both positive and negative effects. "Risk-benefit ratio has become an institutional magic phrase invoked whenever questions on the safety of substances are raised," said Dr. Miller. "It has been spoken so often, I fear that the speakers through the familiarity of their own statements have begun to believe it a reality. However, in our society it is not generally acceptable to place a dollar value on human life," he pointed out.

Is there no good alternative? One possible solution could be to cop out — to allow consumers to decide for themselves what foods to buy — and not have the choices written into laws such as the De-



Mei Williges

laney Clause, which outlaws carcinogens in food in any amount. In this way, the challenge of evaluating all substances for possible regulation would be avoided.

Such challenges should not be underestimated. Consider, for example, the difficulty that would be experienced in passing judgment on vitamin A. "At low levels vitamin A is an essential nutrient," said Dr. Miller. "At high levels it is a potent, toxic substance that is a teratogen, and under some circumstances may possibly be a carcinogen. Its effect at extremely low levels ... is not known. If vitamin A is indeed a carcinogen, how then should it be regulated?" queried Dr. Miller.

Meanwhile, how can the average person be expected to make informed decisions about food substances when scientists themselves are still uncertain of — or unwilling to make judgments on — their relative safety? — K.R. □

Fabricating Food

What's for lunch? How about a flavorful, juicy hamburger on a bun, followed by a dish of smooth, creamy yogurt for dessert? It probably sounds good — and it is. No matter that, in this case, the hamburger may be made from cranberry pulp, the bun from a substance found in lobster and clam shells, and the yogurt from soybeans.

Fabricated foods that taste — and feel — just like the real thing will be an increasing factor in Americans' future diets, thanks to the fact that "food engineering" has come a long way in recent years. Fabricated foods such as artificial bacon bits, whipped toppings, coffee whiteners, and margarine are cheaper, more convenient to serve, and lower in both calories and

saturated fats than the conventional foods they simulate.

Flavor chemists are now able to simulate many desirable flavors, from the unique tang of smoked ham to the "essence" of ripe bananas.

But taste is often associated with texture, and simulating the texture of foods still presents an interesting challenge. What gives a steak its characteristic chewiness or a piece of lettuce its crunch? No one really knows; it's a complex engineering problem that's very specific.

We simply can't yet duplicate the physical properties of many different food materials, including proteins, starches, sugars, and fats, says Dr. Chokyun Rha, associate professor of food process engineering in the Department of Nutrition and Food Science at M.I.T. She hopes to determine how food components react under different processing conditions, thus leading to better fabrications of foods from sometimes underutilized ingredients that the public will like to eat.

Energy considerations will play a larger role in the future in determining what kind of food we eat and where it comes from. According to Professor Rha, the food industry has largely ignored the question of its energy consumption in the past. As an example, it now takes 20 pounds of corn or soybeans to produce every pound of pork in the U.S., but the same dietary constituents could be produced in far more energy-efficient ways. Soybeans, for example, are a very cost-effective source of protein for human consumption. Yet less than 1 per cent of the soybeans produced are used directly as an ingredient in food consumed in the United States. (Soybean is the largest cash commodity in the American economy, but most of the crop is used to provide feed for livestock.)

In other parts of the world where food and energy resources are scarce, the soybean is an inexpensive source of high-quality protein for human diets. Tempeh, a fermented soybean cake or patty, is a staple in the diets of more than 200 million Indonesians. And tofu, another type of soybean curd noted for its subtle and pleasing taste, has been used by the Japanese for hundreds of years as a substitute for meat, chicken, and fish.

And Professor Rha is currently studying other ways that soybeans can be used to make a wide variety of foods. One possibility is a type of soybean "milk" that could serve as a base for cheeselike and yogurtlike products. Such products might be important for cardiac patients, children

allergic to milk products, and patients who cannot digest other forms of protein.

By providing specific dietary needs for specific populations, simulated foods may allow us to "beat nature," as Professor Rha puts it, by creating foods that are actually more healthful than either traditional or natural, unprocessed foods.

Producing food from nonfood sources is yet another aspect of the new area of "food engineering" — one that may offer the additional benefit of solving some waste disposal problems. For example, in a recent study, Professor Rha has found that the pulpy residue from squeezing cranberries for juice can be used to make a type of cranberry "sponge." Filled with an appropriately flavored liquid, this sponge will make a substitute for many succulent food products — perhaps even steak. A sponge from chitosan, a structural material found in lobster and clam shells, may be used in the same way to simulate bread or fruit products by encapsulation of starch or fruit juice.

An "artificial food" such as steak from cranberry sponge is no simple challenge. When we eat steak, the natural juices contained in each bite are released as we chew, and this sense of juiciness must be replicated in "artificial" products. Cranberry cells soak up and encapsulate water in tiny sacs. The water is released under pressure, in this case, during chewing.

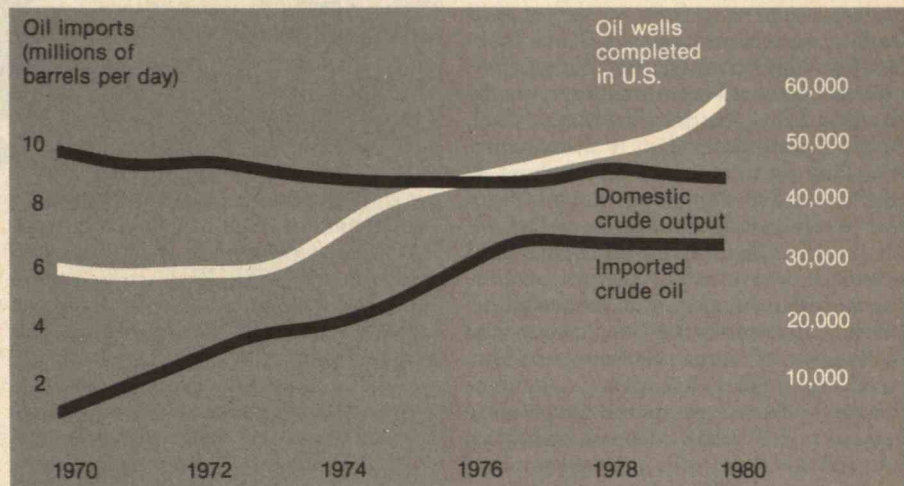
If fabricated foods can be made to replicate the taste and texture of natural foods, will they be accepted by the American consumer? Professor Rha thinks so, though in the past emotional and legal barriers have offered resistance to the production and marketing of fabricated foods. But if fabricated foods are in fact cheaper, healthier, and more convenient to use, they will increasingly win acceptance by the American public, she says. — *Sana Sivvolop* □

Petroleum

The Price of Oil in Our Own Backyard

As we Americans bemoan rising OPEC oil prices, we should gird ourselves for another future shock: the decontrolled prices of our own petroleum.

The Carter administration began a gradual move toward decontrolling oil prices last June. Full decontrol is scheduled for October 1, 1981, when all domestic oil "moves to free market



The graph traces the quantities of crude oil produced in the U.S. and imported since 1970 and projected until the end of this year, and the number of domestic oil wells completed during this period. The number of oil wells to be drilled this year will set a record, but producers plan to maintain overall production levels at 8.5 million barrels per day — as in 1979. The obvious

reason: fully decontrolled prices for domestic oil are scheduled for fall 1981. Note decreasing levels of imported crude since 1977. Note also that higher prices for domestic petroleum will make synthetic fuels that much more attractive — certainly an effective "cost-push" feature for the newly created federal Synthetic Fuels Corp. to factor into that industry-to-be.

prices." No one is talking specifics about postdecontrol prices, but if we don't know the magnitude of the price vector, we can be sure of its direction: indications thus far are that deregulated oil prices will knock you on your ear.

Before getting to those indications, it may be instructive to examine the progress of the transition process. The move to decontrol could certainly be much smoother. Regulations from the Department of Energy are replete with uncertainty — a product of haste and an authorship unfamiliar with the oil industry, charge the oil companies. Interpretations and interpolations of allowable cost rules have produced a flurry (some would say a blizzard) of federal allegations of illegality against the cost allowances and pricing of the nation's 15 largest refiners, with actions against 20 additional firms soon to follow. The total of costs disputed by the DOE to date is more than \$10 billion and increasing; of these, the DOE and the oil companies settled only \$710 million by January.

It is not unlikely that oil consumers have mixed feelings about these proceedings. On one hand, the DOE Office of Special Counsel for Compliance (OSC) is dutifully watchdogging the industry; on the other hand, the OSC has spent about \$117 million to audit the companies and file complaints in court.

Oil & Gas Journal reports that companies in litigation say they were often "forced" to make "their best guess" as to what the DOE allows and that "DOE later invalidated [these guesses] with rules 'clarifications.'" That publication reported that oil companies consider such "clarifications" to be "retroactive applications of additional rulings"; in other words, changing the rules after the cards have been dealt.

In a poker game during the days of the Old West, a person could be shot for breaking house rules, but in the modern oil game, things aren't nearly so precipitous. Despite the industry's protestations of OSC actions, U.S. oil companies are thriving (for example, Standard Oil Co. [Ohio] reports Prudhoe Bay Co. produced its billionth barrel of oil in January), and their future looks very good indeed.

□ A record 58,250 U.S. wells totalling 283 million feet are scheduled for completion in 1980 — an increase of 13.5 per cent over 1979.

□ But production in 1980 will remain constant at just over 8.5 million barrels per day.

□ Imports of crude oil and refined products will fall from an average of just over 8 million barrels per day in 1979 to about 7.5 million barrels per day in 1980.

□ Total U.S. demand is expected to decline — roughly accommodating the de-

crease in imports — from an average of 19 million barrels per day in 1979 to about 18.5 million barrels per day this year.

It all spells a boom time just over the horizon for domestic petroleum. Indeed, today's new domestic oil is already commanding prices that fully match those on the world "spot" market (a euphemism for "black" market, according to *Defense & Foreign Affairs*). These prices are far in excess of current OPEC contract prices — the ones that are making all the headlines:

□ In early January the U.S. Powerline Oil Company of Santa Fe Springs, Calif., made the highest bid ever for domestic crude — \$43.52 per barrel for oil produced in the Teapot Dome oil field in Wyoming, a federally owned property also known as Naval Petroleum Reserve No. 3. The posted price for the same crude was only \$16 per barrel the year before.

□ Other January prices posted for domestic crude oil: \$37.30 per barrel for high-quality west Texas crude, \$35 per barrel for Illinois crude, and in the \$30s per barrel for most others.

But it was OPEC price hikes that made headlines in early February when Saudi Arabia posted a price of \$26 per barrel for some of its crude (the lowest OPEC price posted at the time), and Libya maintained a price of \$34.72 per barrel, the highest posted OPEC price.

Willingness and ability to pay the going rate are the only real "controls" on the spot market, which saw prices climb well into the \$40s per barrel by then. The lure of greater profits has drawn 15 to 20 per cent of the world's oil to the volatile spot market since 1978, when it accounted for only about 5 per cent, according to *Defense & Foreign Affairs*. "The 13-member Organization of Petroleum Exporting Countries, founded in 1960, is for all practical purposes dead," according to a recent staff analysis in that journal, but OPEC "will almost certainly continue as a convenient gentlemen's club."

During this time of impending de facto decontrol of international oil prices, it is especially prudent for the U.S. to wean itself from foreign suppliers of crude. (About 10 per cent of the oil currently imported by American refiners comes from the spot market.)

It is reassuring to hear from the U.S. petroleum industry that the increased revenues made possible by decontrol of domestic oil prices will provide incentives for our nation to produce more of its own product. We can only trust that some of those new shafts won't be misguided. — L.A.P. □

The Threat of Black Gold in Paradise

Ixtoc I, still pouring over 1,250 tons of oil per day into the Gulf of Campeche as this is written, is the world's single largest oil spill. But for the wider Caribbean area, Ixtoc is by no means a singular event. Spills are a fact of life there — at least 50,000 tons of spilled oil a year can be expected simply on the basis of the great amounts of oil produced and transported in the Caribbean.

Offshore oil production in the Caribbean is large — 1.4 billion barrels a year in American and Mexican waters in the Gulf of Mexico and offshore Venezuela and Trinidad. In addition, there is a lively tanker trade throughout the region; 1,250 supertanker cargoes are unloaded every year, and a total of 1.7 billion barrels of petroleum-related fluids pass within 50 miles of land annually.

Observations of Ixtoc suggest that spilled oil is long-lived in the Caribbean environment. The oil/water emulsion near the blowout has a ratio of 60 per cent water and 40 per cent oil. Last summer, as the oil reached the Texas beaches after drifting 600 miles in wind and current, the ratio was only slightly changed: 70 per cent water and 30 per cent oil. (Since then, seasonal changes in winds and currents have protected the Texas beaches, and Ixtoc's oil is presumed to have gone ashore on the east coast of Mexico.)

Mechanical cleanup near the Ixtoc site was unsuccessful; skimming systems deployed by the Petroleum Company of Mexico were able to pick up only about 10 per cent of the oil flow at best, and they were inoperable for much of the time. Even in Texas, where the Coast Guard and conservation agencies mounted a major effort, 80 to 90 per cent of the 10,000 tons of oil that came ashore escaped into the environment.

Clearly, oil spills have the potential for "catastrophic impact" on small countries in the Caribbean. Offshore containment is not likely to be effective, and each individual Caribbean nation must be prepared to protect its own land, concludes Roy W. Hann, Jr., professor of civil engineering at Texas A & M University.

But despite the threat, there is only a "modest oil spill response capability" in the Caribbean today. Few governments maintain contingency plans, few have



specialized resources or people trained to execute plans if they existed, and "only a handful of specialized oil pollution control laws" are even on the books, Professor Hann told the American Association for the Advancement of Science in San Francisco last winter. Indeed, the Ixtoc spill has demonstrated most of the problems with which the Caribbean world must somehow come to terms: the effort to stem the flow of oil has been unsuccessful, those responsible have been "unwilling to accept liability," the issue of compensation for those who have suffered economic damage remains unresolved, and "there has been a general lack of exchange of technical information." (The latter is in marked contrast to the *Amoco Cadiz* spill in France, where Professor Hann found that much knowledge was gained through the sharing of experiences among many French authorities.)

The issue comes to a head in 1980 because the Tanker Owners' Voluntary Insurance Fund, under which the Caribbean's current modest oil-spill preparations have been covered, is giving way to an Intergovernmental Civil Liability Convention. Now the Caribbean nations, and all other nations, must assume responsibility for participation in this new plan, devising their own individual or regional programs and writing their own regulations for tankers in national waters. — J.M. □

The Tie That Binds OPEC's Price to U.S. Stagflation

The price of oil affects the price of essentially everything we buy — the fuels, lubricants, and hydraulic fluids for our cars, of course; the fuel to cultivate, process, and move food to market; the raw materials for countless chemicals and plastics . . . Clearly, changes in the price of oil affect everything else in the economy too.

When the price of oil goes up unexpectedly, as it did in 1973-74, the price of everything else also moves unexpectedly upward; inflation worsens, people grow poorer, and there is recession. How much of the "stagflation" of 1974-75 was due to the oil price hike of that same year? What of the new round of crude oil price increases in 1978-79 and those inevitable in the years ahead? Just how strong is OPEC's grip on U.S. prosperity?

To answer these questions, economists Knut A. Mork of the M.I.T. Energy Laboratory and Robert E. Hall of Stanford University devised a computerized mathematical model of the U.S. economy (with energy prices as one explicit variable) and "ran" it through a series of analytical simulations. Here are some of their findings:

- Prices rose by 4 per cent in 1974 and by another 1 to 2 per cent in 1975 because of that year's boost in energy prices.
- The oil price increase of 1974 caused decreases in real output (measured in 1972 dollars) of \$30 billion in 1974, \$66 billion in 1975, and perhaps \$50 billion in each of the following three years.
- Unemployment was 1.1 per cent higher in 1974 and 1.9 per cent higher in 1975 because of OPEC's price rises.
- The effects of the 1978-79 oil price increase are at least two-thirds as great as those of the earlier shock: the outlook by mid-1979 was for 1.8 extra percentage points of inflation in 1979 and 1.3 in 1980. The shortfall in real growth in 1980 will be about 2.8 percentage points. Unemployment may be up by 1 per cent in 1980 and real wages down 2 to 3 per cent because of energy price increases alone. Domestic investment will decline "sharply" in 1980 and 1981 (although foreign investment may well increase significantly because of the devaluation of the U.S. dollar).

To Drs. Mork and Hall, the information can be summarized this way: "Most of the extraordinary inflation and almost

What the OPEC price shock of 1974 did to the U.S. economy. A simulation by M.I.T. economists shows that OPEC's sudden price increase was a "major cause" of U.S. "stagflation" in the mid-1970s. The lower lines show conditions that might have been experienced with stable energy prices; the upper lines, real conditions.



all the recession" of 1974-75 can be attributed to the 1974 oil price shock. The 2.8 per cent shortfall in real growth assigned to the 1978-79 price hikes is itself "large enough to be called a recession," and it all "adds up to another severe dislocation of the U.S. economy in 1979-80 because of an energy shock.

"If these analyses are correct, the U.S. is headed for a significant increase in unemployment and further bad news about inflation."

What can we do to bring a little hope into this bleak outlook?

For one thing, say Drs. Mork and Hall, we can proceed with decontrolling domestic oil prices. Higher prices for U.S. producers will result in increased domestic production, so that a larger part of the extra revenues will go to Americans rather than foreign producers when prices go up.

Import quotas are bad news because they represent an artificial mechanism in a market that operates best — that is, most efficiently — when free. Massive government investment in synthetics looks risky, too: it is expensive and could easily lead to "stagflation" in the same way the conflict in Vietnam did in the 1960s.

The most promising responses are eco-

nomie policies that increase investment. High interest rates intended to control inflation will tend to encourage recession. Fiscal expansion (tax reductions, lower interest rates, and larger government expenditures) to fight recession will fuel inflation.

Drs. Hall and Mork come out for monetary expansion. According to their model, if the Federal Reserve had eased monetary policy in 1979, an increase in the growth in money supply of 2 percentage points in 1980 and 1 percentage point in later years would have been enough to maintain unemployment at 6 per cent. Easier monetary policy would have enlarged productive capacity by encouraging new investment, and this would have moderated — at least for several years — the effect of inflation.

Reduced payroll taxes would have a similar effect on investment by allowing employers' labor costs to fall. But there would be no pressure toward inflation, since wages would not decline, and no pressure toward recession. Investment could also be encouraged by an increase in the investment tax credit or by liberalization of depreciation rates.

But none of these responses — or all of them together — directly affect the ties between the U.S. economy and oil prices. Conclude Drs. Mork and Hall, "The U.S. is vulnerable to substantial macroeconomic dislocation from unexpected increases in the price of energy, and not too much can be done in the near future to reduce that vulnerability." — J.M. □

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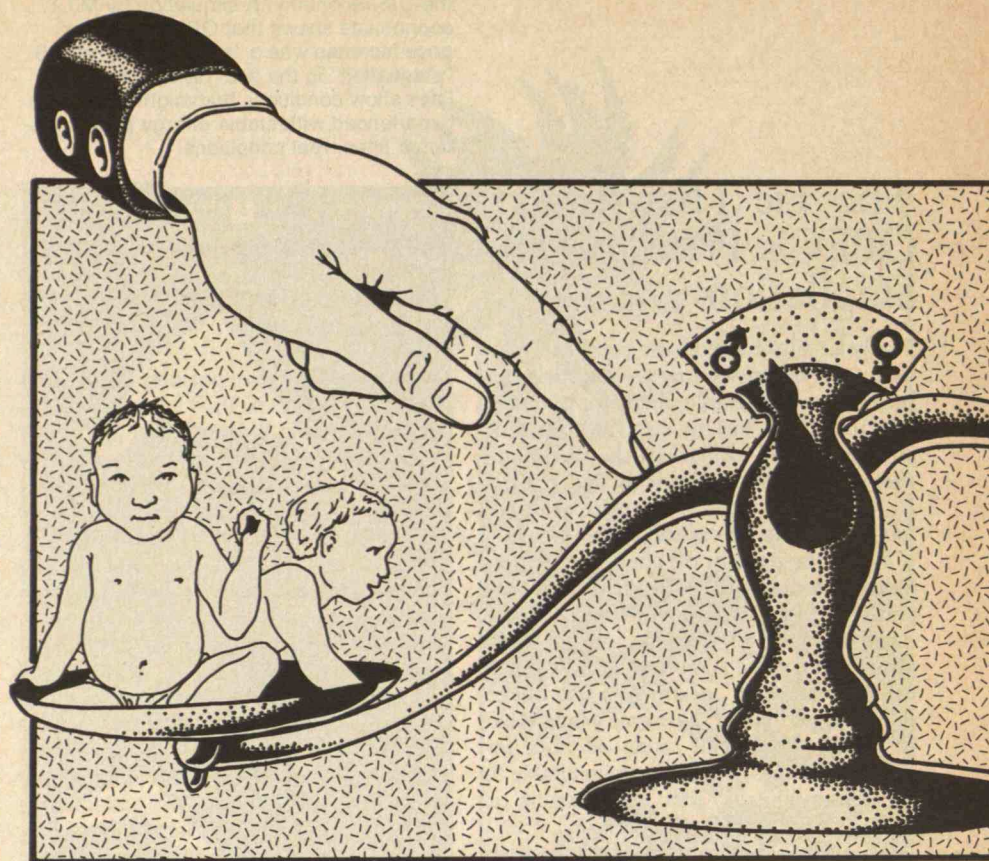
The Implications of Sex Preselection

"Do you want a boy or girl?" The answer from expectant parents more often than not is "a boy" — boys have long been prized in societies based on hunting and nonmechanized agriculture. But these activities are no longer so labor-intensive. Still, "social, psychological, and demographic research indicates that a major outcome of the widespread use of sex preselection technology would be an ... increased number of males and a decreased number of females in the population," according to Roberta Steinbacher, a psychologist who chairs the Department of Urban Studies at Cleveland State University. She spoke at the American Association for the Advancement of Science meeting in San Francisco about studies done to determine the effects of widespread sex preselection. All studies show a preference for male children, and there is no evidence that this preference — which is strongest in India — is declining, either in the U.S. or the developing countries.

About 120 males are conceived for every 100 females; but more males than females are miscarried so that 105 males are born for every 100 females, according to John L. Sullivan, a pediatrician at the University of Massachusetts at Worcester. Males who die in early childhood also outnumber females, so that by the time people reach reproductive age, the number of surviving males roughly equals the number of surviving females — a fact that could be considered advantageous from an evolutionary standpoint. Dr. Sullivan writes in the *American Journal of Diseases of Children*, "It is as if nature, knowing of the male's immunological inferiority, tried to compensate by having more males conceived than females." That women outlive men by an average of eight years is not part of nature's design, according to Dr. Sullivan, but is due to environmental and cultural factors — such as occupational hazards, cigarette smoking, and alcohol abuse — that presently affect more men than women.

Disturbing the delicate balance of the sexes could lead to a surplus of males, increased male homosexuality, and polyandry, said Dr. Steinbacher.

A more optimistic use of sex selection could be the limitation of population growth, since parents may complete their families with fewer children if the children



they do have are of the desired sex. However, research findings in this area have not been entirely consistent.

Sex preselection could also have a telling effect on birth order. All the studies analyzed by Dr. Steinbacher have shown a strong preference for a male first-born or only child. Several studies have substantiated that first-borns are predominant in a cross section of college populations; and as early as 1874 a predominance of first-borns was discovered among a group of British scientists.

"Social scientists and biologists have debated the reasons for the first-born phenomenon for years," said Dr. Steinbacher, "but the critical question here is not 'why,' but rather what will an increase in first-born males mean for women and for society? What are the implications of being second-born and knowing that you were second choice?"

Serious discussions of the long-term effects of technology are often treated as science fiction, but the medical techniques of sex preselection are here and now. "Whether or not these techniques are currently effective is not the issue," said Dr. Steinbacher. "Some are; some are not. The overriding issue is that research is progressing at a rapid pace and will increasingly provide the means for sex predetermination with remarkable accuracy."

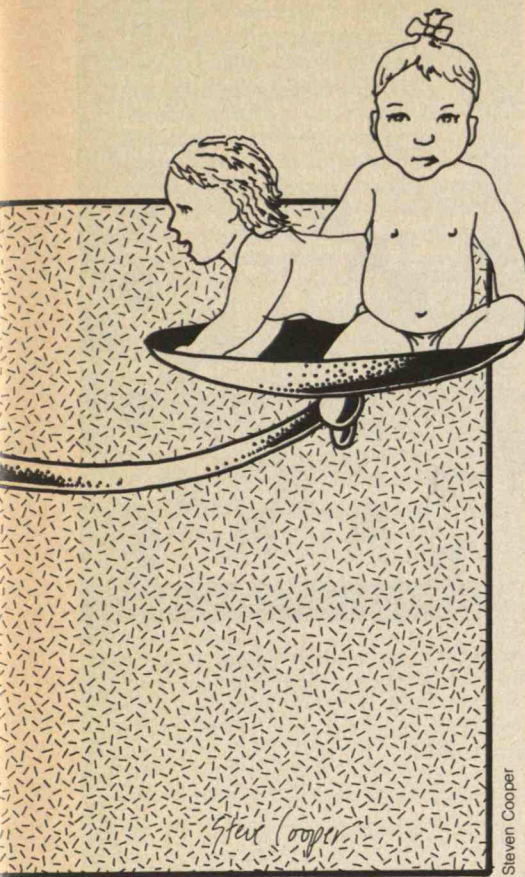
The most accurate current method of sex preselection is selective abortion. With

the use of amniocentesis — withdrawing of amniotic fluid, usually to test for chromosomal or other irregularities, not just sex — the option of abortion on the basis of sex became possible. But amniocentesis cannot be reliably performed until 16 to 20 weeks after conception; other techniques are being perfected to determine the sex of a child as early as 47 days after conception.

The best-known technique for sex selection before conception is timing intercourse in relation to ovulation. There are several difficulties with this method, but under controlled conditions artificial insemination has produced the desired sex about 80 per cent of the time. In addition to timing, precoital douches have been used to raise the acidity level of the vagina to favor the conception of a female, or to increase the alkaline level to favor conception of a male.

Extensive research has also been done on in vitro separation of sperm that bear X and Y chromosomes that would then be used in artificial insemination. Other work is being done on such things as pills for men to stop the production of one type of sperm, pills or gels for women to render the reproductive tract inhospitable to either X- or Y-bearing sperm, and filters that might allow only the smaller, male-producing sperm to pass.

"Scholars from a wide variety of disciplines have commented on the implications of sex-preselection technologies,"



said Dr. Steinbacher. "Whether they support or discourage further research or applications of these technologies, it is clear that sex-preselection research has far outdistanced serious discussion of its ethical, social, legal, and demographic implications." — K.R. □

Toxic Chemicals and Reproduction

Whereas it takes two people — a man and a woman — to produce a baby (a fact of life that few can deny); and whereas certain toxic chemicals in the workplace adversely affect human reproduction, then it is reasonable to suppose that eliminating such threats for both men and women is a sound and equitable strategy. But the prevailing approach is to remove the worker from the threat rather than the threat from the worker. And whether it derives from chivalry, sex discrimination, or the simplistic notion that because women give birth it is they who exclusively propagate the damage, the rule in worker removal appears to be "ladies first."

"Most substances don't discriminate between men and women," says Wendy Williams, professor of law at Georgetown University, "but many companies do." General Motors, for example, will not hire fertile women for work that involves lead, and American Cyanamid Co. has a similar policy that was recently the object

of national attention when it was disclosed that four women had themselves voluntarily sterilized to keep their jobs. A *New York Times* survey showed that most of the plaintiffs in 40 cases pending before the Equal Employment Opportunity Commission are women excluded from their jobs because of alleged "hypersusceptibility." However, while women may be relieved of jobs for their own reproductive "protection," men remain unprotected, points out Professor Williams.

According to Dr. Jeanne M. Stellman, executive director of the Women's Occupational Health Resource Center at Columbia University, the ladies-first approach is fallacious: sperm are no less susceptible to damage from environmental causes than are ova. But this fact is generally overlooked because the reproductive systems of women — not men — are most often studied. For example, Dr. Jeanne Manson, assistant professor of environmental health at the University of Cincinnati and a specialist in reproductive toxicology, cites adverse reproductive effects of carbon disulfide that have been confirmed at relatively low levels in women. Its effects on men are not known, she says, because there have been no comparable studies on men. Even the study of reproduction has been dominated by women, or perhaps relegated to them, as the above citations may suggest.

Ralph C. Dougherty, professor of chemistry at Florida State University, has recently disclosed some inconclusive but unsettling findings on male fertility. He reports that "sperm density distributions of U.S. males have shifted to lower values over the past 30 years. Average and median sperm densities for U.S. males prior to 1950 were in the range of 90 to 145 million per milliliter. Subsequent to 1970, the median values for sperm densities have ranged from 50 to 80 million per milliliter." Using the threshold of 20 million or less sperm per milliliter to indicate functional sterility, Dr. Dougherty concluded that 23 per cent of the men (college students) in his most recently reported study were functionally sterile. He suggests that "toxic substances in the environment may be partially responsible" — samples of the students' seminal plasma contained toxic substances such as PCBs and pentachlorophenol at greater-than-background concentrations — but he also suggests that "sociological and behavioral factors may be partially responsible" as well.

Indeed, some industrial concerns have alleged that even for workers exposed to

substantial levels of hazardous chemicals, "sociological and behavioral factors" are the primary causes of health and reproductive problems. Anthony Mazzocchi, director of occupational health and safety for the Oil, Chemical, and Atomic Workers International Union, responds as follows: "Of course there are many workers who smoke too much, drink too much, are promiscuous, and so on. But when men and women spend their days in miserable, unhealthy environments doing meaningless, alienating work, this should come as no surprise." He insists, moreover, that blaming such factors for reproductive problems is a "diversionary and victim-blaming" tactic used by some industries to avoid expensive improvements in working conditions.

One way around this issue is the growing industrial practice of genetic screening. New but relatively simple biochemical techniques of cytogenetic testing are being used to detect chromosomal abnormalities and "high-risk" individuals. A moral dilemma then unfolds: whether to eliminate the threat or remove an individual — or group.

Dr. Jonathan King, professor of biology at M.I.T., suggests that strategies now being determined for the control of hazardous chemicals take their cues from the historic debate on communicable disease. There were two schools of thought, for instance, on responses to the New England typhoid epidemic at the turn of the century: one was to quarantine the carriers; the other, to develop safe public water supplies. The proper decision now, as then, he maintains, is to address the source of the disease. Dr. Marvin S. Legator (director of the Division of Environmental Toxicology at the University of Texas), an advocate of cytogenetic testing, agrees: "These tests are diagnostic for the presence of hazardous materials in the workplace. They serve as advanced-warning systems for chemicals such as radiation badges [indicate] the presence of harmful radiation." Moreover, for "every single instance in which we were able to show a significant effect at the cytogenetic level . . . the chemicals have been known to be hazardous in terms of carcinogenicity and mutagenicity as well."

Eliminating from the workplace "genetically active" compounds that threaten the unborn children of workers, therefore, may also protect the workers themselves. Says Dr. Legator: "[When] we find these effects well in advance of clinical effects, we do not need to wait to count the dead bodies." — S.J.M. □

The Flowing Stream of Science

1 H	2 C	3 X	4 S	5 T	6 U	7 E		8 C	9 H	10 L	11 N	12 T	13 X	14 A	15 P	16 U	17 C	18 S	19 Y		20 J	21 I	22 X	23 M		24 M
25 H		26 T	27 A	28 D		29 M	30 A	31 S	32 E		33 S	34 C	35 I	36 U	37 G		38 F	39 B		40 C	41 H	42 Y	43 D	44 K	45 S	46 U
47 Q	48 A	49 R	50 J	51 L		52 A	53 K	54 O		55 A	56 F	57 Q	58 S	59 C	60 J	61 X	62 N		63 X	64 B	65 R	66 T	67 O	68 S		69 V
70 R		71 J	72 I	73 M	74 V	75 C	76 E	77 K		78 B	79 J	80 U	81 A	82 G	83 M	84 V	85 E	86 N	87 P	88 S	89 W	90 Y		91 W	92 S	
93 A	94 P	95 O	96 W	97 C	98 S	99 G	100 E		101 H	102 A	103 V	104 J	105 D	106 Q	107 S		108 H	109 J	110 S	111 A	112 Y	113 O	114 Q		115 U	116 C
	117 G	118 O	119 X	120 I	121 M	122 V	123 C	124 A	125 W		126 S	127 I	128 F		129 T	130 A	131 L	132 X	133 Q	134 O	135 V	136 N	137 M	138 S		139 K
140 H	141 T	142 W	143 C	144 U	145 E		146 B	147 H	148 O	149 Y		150 U	151 F	152 L		153 O	154 S	155 V	156 Y	157 I	158 M	159 F	160 T	161 E	162 K	163 Q
164 X		165 D	166 N	167 J	168 K		169 B	170 S	171 H		172 X	173 J	174 L	175 S	176 H	177 W		178 U	179 G	180 I		181 N	182 D		183 S	184 V
185 H		186 A	187 I	188 U	189 C	190 L	191 M	192 R	193 S	194 V	195 X	196 H	197 P		198 G	199 F	200 Y	201 V		202 H	203 C		204 L	205 K		206 S
207 Y	208 G		209 C	210 H	211 T	212 V	213 A	214 I	215 P	216 M		217 Q	218 M	219 K	220 S	221 H		222 C	223 H	224 W	225 B	226 J	227 S	228 A		229 S
230 V		231 A	232 G	233 S		234 M	235 A	236 D		237 X	238 I	239 K	240 S	241 L	242 D											

Complete the word definitions; then enter the appropriate letters in the diagram to complete a quotation from an article on social evolution. The first letters of the defined words give the author and title from which the quotation is taken. Black squares in the diagram indicate the ends of words; if there is no black square

at the right end of the diagram, the word continues on the next line. A solution to this Tech-Crostic will be in the next issue of the Review, when another of Mr. Forsberg's puzzles will also appear. Readers are invited to comment — and to suggest favorite texts for future puzzles.

- A. Early animated cartoon by Winsor McKay (3 wds.)
 124 30 213 52 186 102 48 27 111
 93 81 231 130 228 14 235 55
- B. Bring to pass, accomplish
 225 146 39 64 78 169
- C. 1854 document recommending U.S. acquisition of Cuba (2 words)
 17 222 8 34 2 123 209 40 97
 143 116 189 203 59 75
- D. Opera by Puccini (with "La")
 43 105 182 242 165 236 28
- E. In the form of drops
 145 76 161 7 85 32 100
- F. Member of elite Greek mountain infantry
 128 199 159 38 151 56
- G. Framework
 37 117 208 82 198 99 232 179
- H. Motto of Kansas (4 words)
 196 221 202 108 223 176 210 101 185
 9 140 25 41 171 147 1
- I. Pakistani town, cantonment, and district
 127 35 120 72 157 238 21 187 180
 214
- J. "Spend an hour in ____," (G&S, "The Gondoliers")
 109 79 167 104 71 226 173 60 50
 20
- K. Legal right to possession
 168 239 205 44 219 77 53 162 139
- L. Oriental smoking apparatus
 131 10 241 51 174 204 190 152
- M. Political song, 1687, helped drive James II from throne
 137 158 121 191 83 29 24 234 216
 23 73 218
- N. Meaning, import
 181 11 86 62 166 136

- O. Andalusian Gypsy style of music and dance
 95 67 134 113 54 118 153 148
- P. Israeli port on Gulf of Aqaba
 94 87 197 215 15
- Q. Nobel laureate in Chemistry, 1909
 163 114 133 217 47 57 106
- R. A digit
 70 49 65 192
- S. Ludwig Boltzmann's discipline (2 words)
 107 233 58 183 154 68 206 98 45
 240 220 92 170 175 110 33 88 229
 138 18 126 227 4 193 31
- T. Cartridge for film or tape
 129 160 12 141 66 211 26 5
- U. Result of creativity
 46 36 6 115 80 178 188 16 150
 144
- V. Limit of observability of a black hole (2 words)
 122 155 212 135 194 184 69 103 74
 84 230 201
- W. Character in Shakespeare's "The Merchant of Venice"
 89 125 224 96 177 142 91
- X. Bindweed
 3 119 164 61 172 13 22 195 63
 237 132
- Y. Stress, insistence
 200 149 42 207 112 90 156 19

Solution to February Crostic

What mathematician has ever pondered over an hyperbola, mangling the unfortunate curve with lines of intersection here and there, in his efforts to prove some property that perhaps after all is a mere calumny, who has not fancied at last that the ill-used locus was spreading out its asymptotes as a silent rebuke, or winking one focus at him in contemptuous pity?

Lewis Carroll, *The Dynamics of a Particle*

- | | |
|---------------------------|----------------------------|
| A. Coaster | O. Sufficient for his Need |
| B. Athene | P. Orthognathous |
| C. Rappahannock | Q. Flute |
| D. Ranunculus | R. Affirmative |
| E. Ophiuchus | S. Possessed |
| F. Littlest State | T. Apportionment |
| G. Lanthanides | U. Ruthenium |
| H. Das Glasperlenspiel | V. Twice Times Two |
| I. Yossarian | W. Interweave |
| J. Not by a Fireman's Hat | X. Chromatography |
| K. Awkward | Y. Lophophore |
| L. Methylamine | Z. Ettore Bugatti |
| M. Involvement | |
| N. Chretien de Troyes | |

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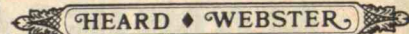
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Autos in a Crystal Ball

A massive, international study of the future of the automobile proposed to be completed at M.I.T. by 1983 at a cost of up to \$3.5 million has received its first funding — a \$300,000 grant from the German Marshall Fund. The goal is to develop some policy options for dealing with the many serious problems brought to government and society by the automobile; there will be research and a series of international forums in the U.S., Western Europe, and Japan.

President Jerome B. Wiesner of M.I.T. embraces the program because it exemplifies what he calls M.I.T.'s special commitment to address major problems that are "at once technical, political, social, economic, and managerial." Project directors are Professor Daniel Roos, director of the Center for Transportation Studies, and Professor Alan A. Altshuler, head of the Department of Political Science. □

"Meteor": Can M.I.T. Survive Its Science?

Hollywood still has no understanding of elementary physics.

That's the complaint of students in M.I.T.'s Space Systems Laboratory after seeing the recent \$17-million major motion picture, *Meteor*. Comments of those who saw the film ranged from "fun, if you ignored the glaring [technical] errors," to "hokey."

Some of the many errors in special effects cited by the students:

- Instantaneous communication with a spacecraft several light minutes away.
- A spacecraft being easily detoured and stopped in the asteroid belt.
- The presence of American and Russian nuclear warheads in Earth orbit.

The Tech also complained in its review about "unidirectional tidal waves" and "defiance of center-of-mass laws."

There was praise, however, from one student, Kent Massey, 81, on the high degree of accuracy of the Russian spoken in the film.

The movie takes its situation — a large asteroid has been perturbed into an orbit that puts it on a collision course with Earth — from M.I.T.'s Project Icarus, a problem presented in the spring of 1967 to graduate students in Advanced Space Systems Engineering. After a semester of work, the students presented a plan that included sidetracking *Apollo Saturn V*

rockets and arming them with nuclear charges that would be used to destroy or deflect the asteroid.

In *Meteor*, however, nuclear warheads from both the United States and Russia are sent to destroy a five-mile-wide asteroid. The joint effort succeeds only in breaking the asteroid into smaller chunks, three of which hit the Earth. In true disaster-film style, one causes an earthquake, another causes a huge tidal wave, and the third sets off an avalanche.

Despite the large number of technical inaccuracies, neither students nor faculty seemed to worry that the film will reflect poorly on M.I.T. or Project Icarus. The students point out that the only references to M.I.T. are a legend at the end of the film describing Project Icarus and the fact that the character portrayed by Sean Connery is a professor from the Institute. As Professor Louis D. Smullin, S.M. 39, put it, "If you worried about things like that, you would be worried all the time." — John C. Brewer, 83 □

Capitalism: Always on the Edge of Extinction but Still Going Strong

Is capitalism an endangered species?

Yes — always, says Carl Kaysen, David W. Skinner Professor of Political Economy at M.I.T.

Karl Marx predicted the downfall of capitalism. Capitalist nations would be unable to survive the cycle of prosperity followed by depression, he said; and the "working masses," increasingly impoverished by their capitalistic managers and landlords, would ultimately seize power. Neither has happened — at least not yet.

Professor Joseph A. Shumpeter of Harvard predicted the demise of capitalism from a very different cause: the children of capitalists — relieved by their parents' affluence from the necessity to work, he said — would become intellectuals; and their criticism of capitalism would bring it to its knees. That hasn't happened, either.

The plain fact is that "most people in the world would rather be where we are than where they are," Professor Kaysen told a seminar of M.I.T. alumni last fall.

But there are some causes for concern, some inherent weaknesses of capitalism of which we should be aware, and some new dangers which we hardly yet understand:

- The capitalist nations are in the minority, and most of the world's population growth today is taking place in the

noncapitalist countries.

□ Any system in which unequal division of wealth and power is inherent rests on the consent (or suppression) of those who have less. Democracy has given political power to many of the underprivileged people in every capitalist country, but the many have not taken away the wealth of the few. To Professor Kaysen the balance seems "precarious."

□ Capitalism depends on the capacity of its defenders to defend it, and they are mostly the relatively wealthy. But in our present democratic society the power of such wealthy people is less than it used to be, with the result that "the many who have votes tend to win over the few who have money." Let the latter take courage, said Professor Kaysen: "We need them to be stubborn but not obstinate."

In this changing world, capitalism has at least two things going for it:

□ The rise of the managerial class means that the doors to management careers have been opened to countless people who would never have achieved those responsibilities 100 years ago. This managerial class is an integral part of capitalism and its members can be counted on for capitalism's defense.

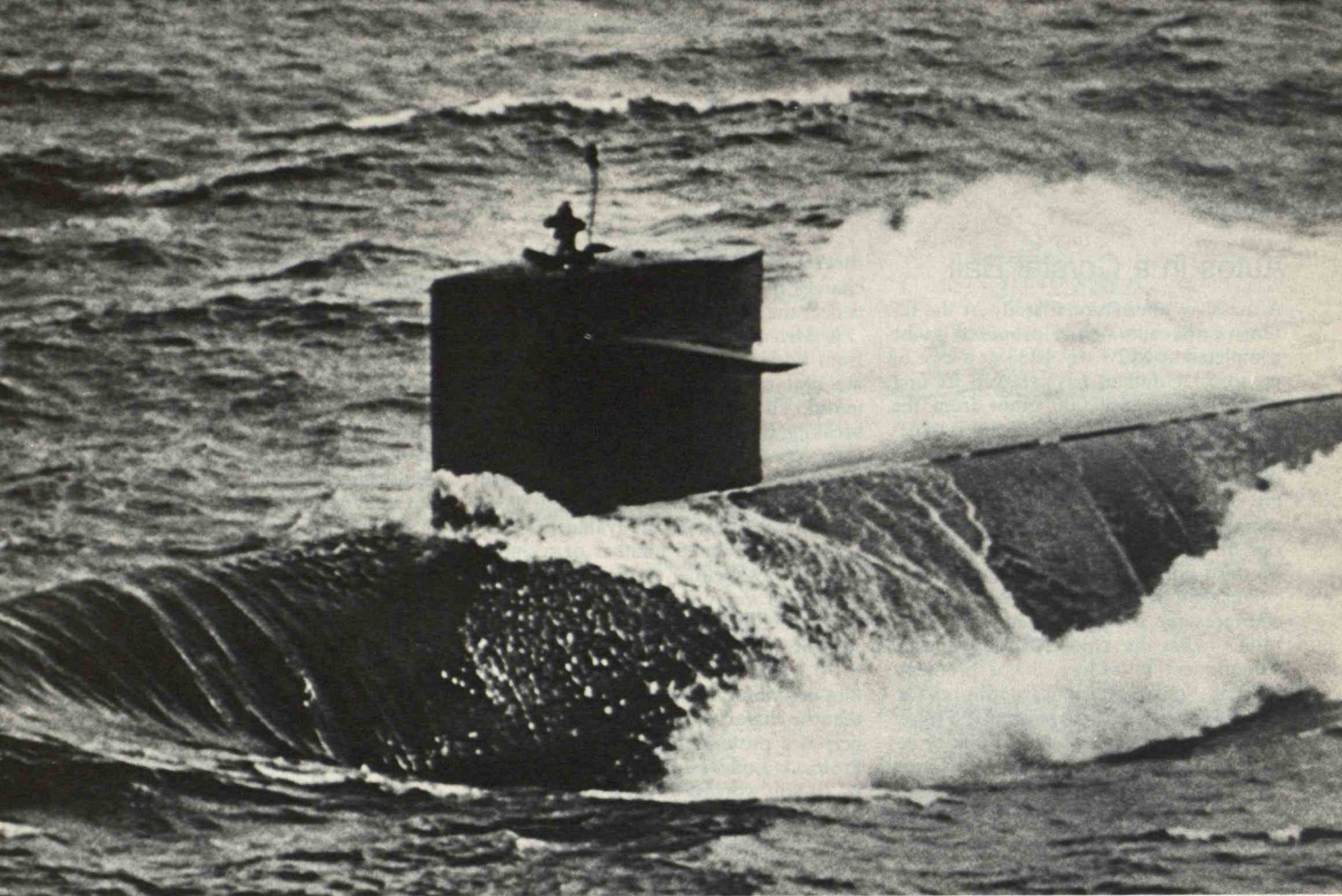
□ The wider accessibility of higher education has "fostered the notion of competitive opportunity," another idea integral to capitalism, said Prof. Kaysen. □

Managing the Business of Managing Cells

How, if at all, should the burgeoning new applied genetics industry be regulated?

To help answer that question, the Office of Technology Assessment (OTA) has commissioned the first detailed study of the industry now emerging out of the new science of microbial genetics, including recombinant DNA, from M.I.T. and the New York financial and investment banking firm of F. Eberstadt and Co.

The industry, which seems to hold promise of many new processes and products, has already attracted some \$150 million in venture capital and "explosive growth" may be just ahead. The assessment team for OTA will include members of the Sloan School of Management, the Department of Nutrition and Food Science, and the Harvard-M.I.T. Division of Health Sciences and Technology, with Professor Anthony J. Sinskey as principal investigator. □



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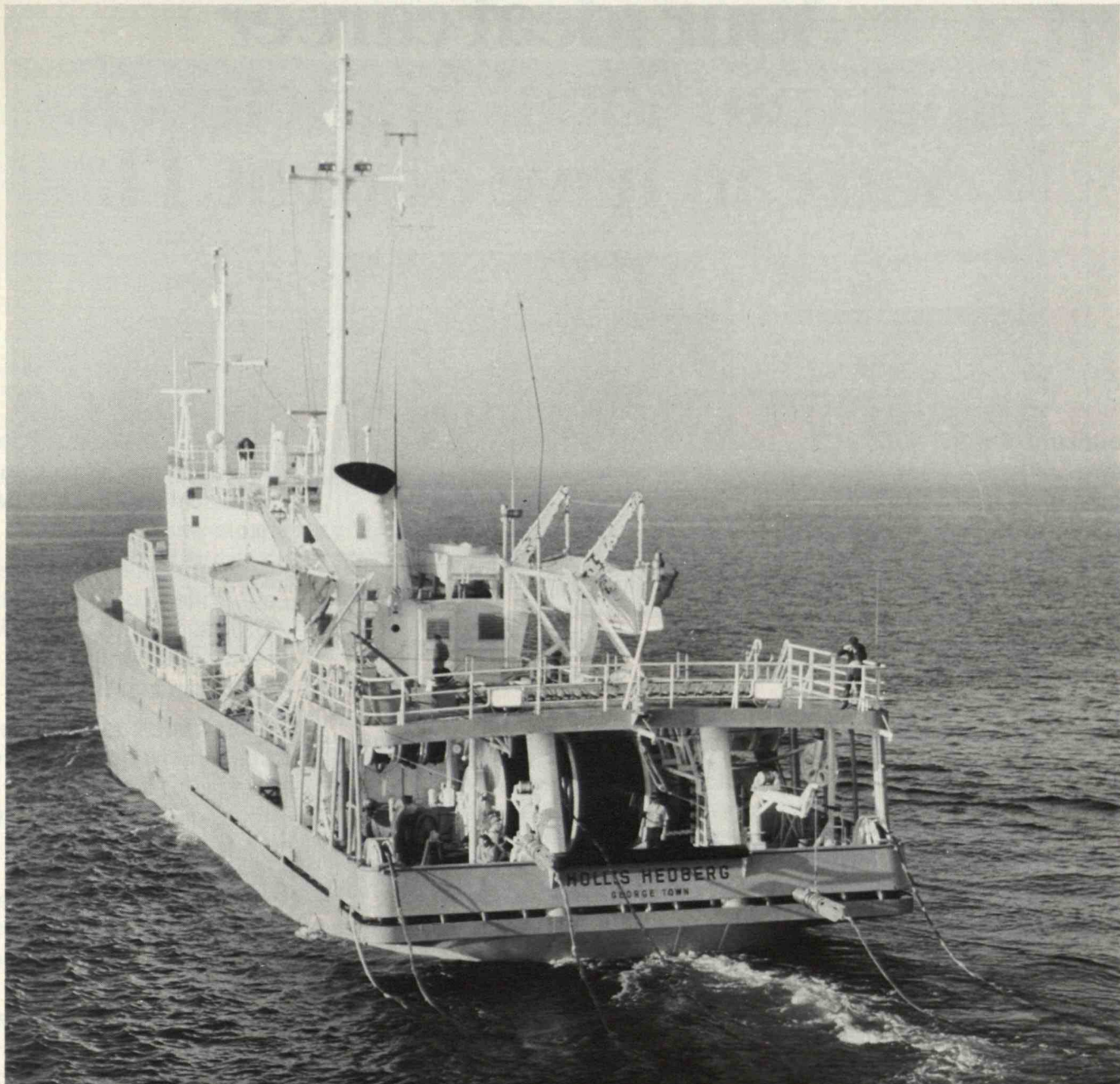
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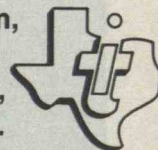
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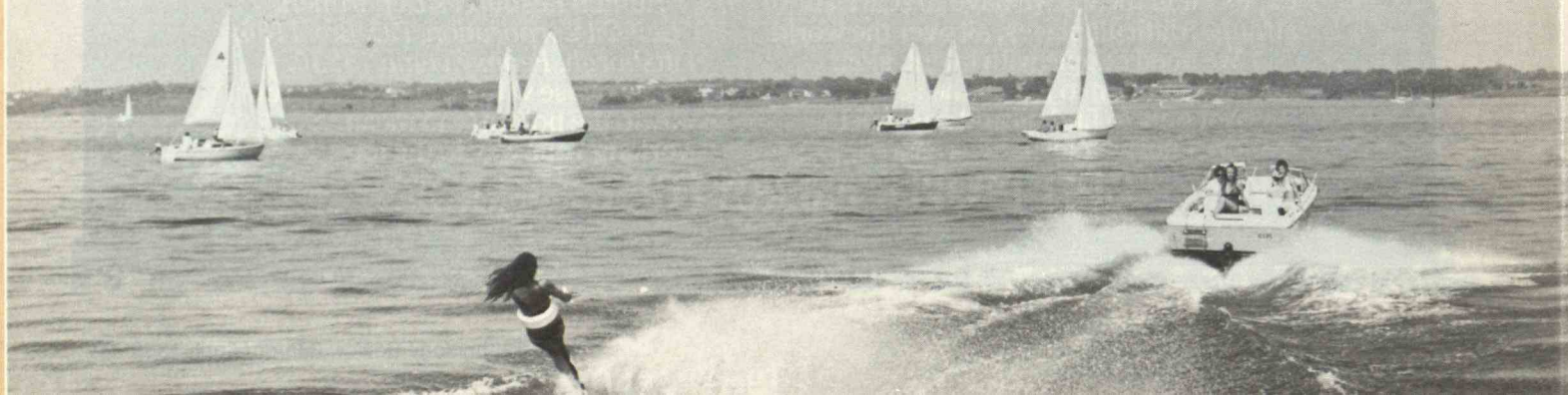
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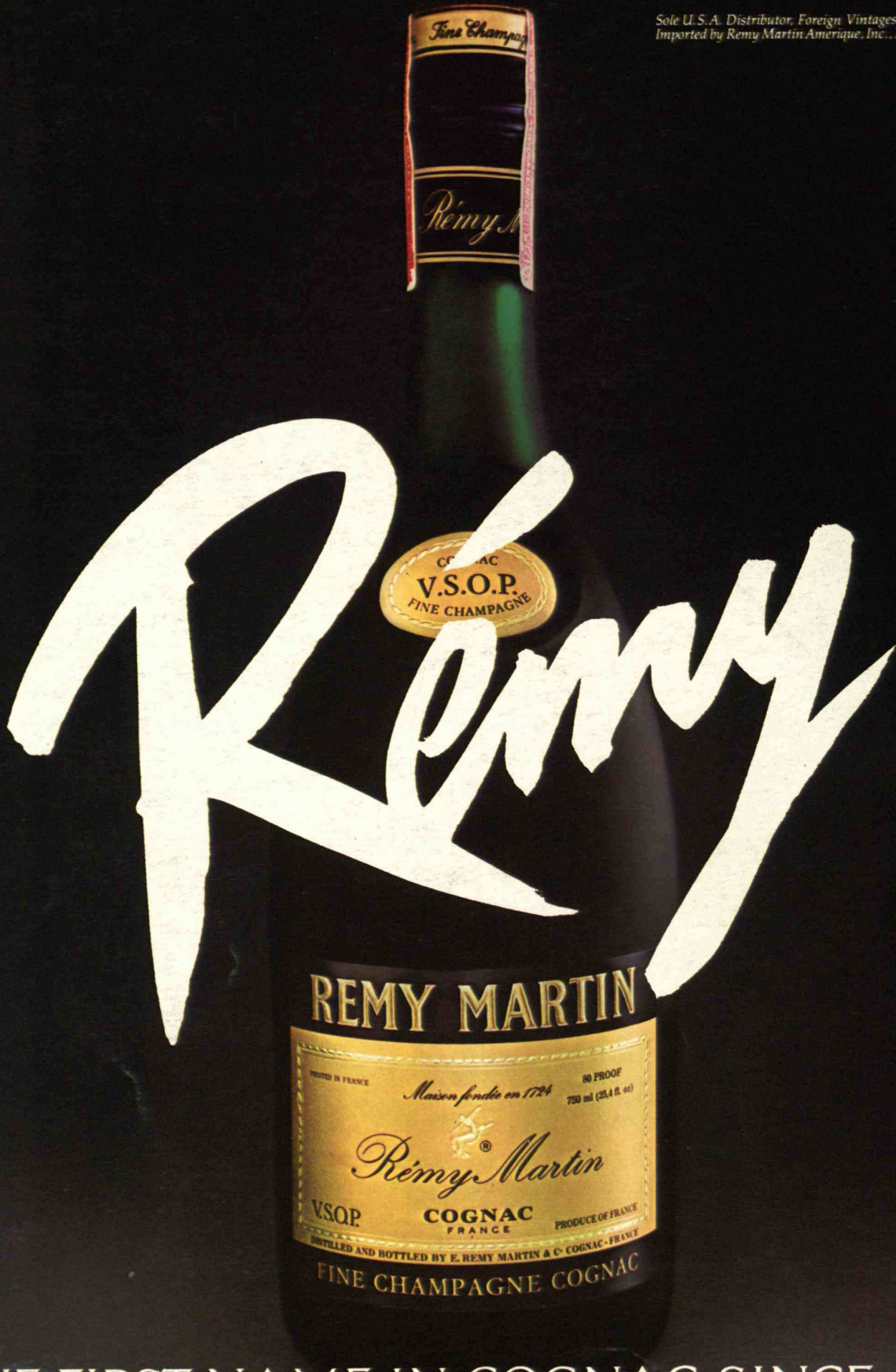
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